

International Labour Conference

251
TWENTIETH SESSION

GENEVA, 1936

**Safety Provisions for Workers
in the Building Industry**

with reference to

Scaffolding and Hoisting Machinery

Item VIII on the Agenda

GENEVA

INTERNATIONAL LABOUR OFFICE

1936

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PREFACE

It is now several years since the International Labour Office first began to concern itself with the safety of workers in the building industry.

After an exchange of views with the International Federation of Building Workers in 1930, researches were undertaken with a view to the preparation, as a first step, of a survey of the law and practice as regards scaffolding; the outcome of this was the publication of the scaffolding regulations of a number of countries in the *Industrial Safety Survey*, Vol. VIII, No. 1 (1932).

It was intended to follow this up by a report on the conditions obtaining in various countries as regards the safety of scaffolding, this report to be based on studies and enquiries undertaken on the spot by an expert.

Then, in October 1932 the Office received a letter from the International Federation of Building Workers asking it to make a special study of all questions relating to safety in the building industry. This letter was submitted to the Correspondence Committee on Accident Prevention at its session of December 1932.

The Committee unanimously recognised the great importance of the question¹ but at the same time realised the very great difficulties in the way of an enquiry into all its aspects. While therefore it would have been inadvisable to attack the problem as a whole, the Committee was of opinion that certain specific questions, clearly defined, might well form the subject of enquiries which, in their turn, might furnish a basis for international action. Various members of the Committee drew attention to certain specially important points which, in their view, could be studied. These included in particular:

- (a) The compilation and comparison of statistics of accidents in the building industry;
- (b) The appointment of workers' delegates for the supervision of buildings under construction;

¹ Cf. "Report on the Sixth Session of the Correspondence Committee on Accident Prevention" (*Industrial Safety Survey*, Vol. IX, No. 3, p. 62).

- (c) The collection and comparison of national laws and regulations;
- (d) The construction, etc., of scaffolding;
- (e) The use of electricity in building;
- (f) Safety of cranes and other hoisting appliances.

The Committee further considered that it would be desirable to investigate the conditions which should be required as regards safety in new methods of building large edifices, methods which are largely uniform in all countries. The Committee did not, however, feel it possible at that session to include any of these particular points in its programme.

At its Sixty-first Session (February 1933) the Governing Body took note of the report of the Committee on Accident Prevention and instructed the Office, with a view to further consideration of the matter, to proceed with the collection of material from the various countries on the number and causes of accidents in the building industry.

Meanwhile, further communications were received by the International Labour Office from building workers' organisations in various countries urging that the enquiries should be undertaken as promptly as possible.

At this stage the question was also taken up by the International Labour Conference, which, at its Seventeenth Session (1933) unanimously adopted the following resolution, submitted by Mr. Moore, South African Workers' Delegate, and Mr. Sakamoto, Japanese Workers' Delegate:

"Whereas workers in the building industry are exposed to great dangers owing to defects of scaffolding, cranes, girders and other appliances or the imperfection of security provisions in general;

"Whereas the laws and regulations in force concerning safety measures to be taken in building operations are of interest and importance to workers in countries where such laws and regulations do not exist;

"The International Labour Conference invites the Governing Body to consider the desirability of instructing the International Labour Office to make a general study of the safety provisions for workers in the building industry, with a view to placing that question on the agenda of an early Session of the International Labour Conference."

This resolution was considered by the Governing Body at its Sixty-fourth Session (October 1933) and the Office was authorised:

"(1) To complete the compilation of laws and regulations so as to cover all the questions mentioned in the resolution;

“(2) To undertake the practical work previously contemplated by having a study made on the spot of the safety devices and methods used in the various countries to ensure the safety of scaffolding;

“(3) To prepare a report, on the basis of this work, which would be submitted to the Governing Body at a subsequent session and which would enable the Governing Body to judge whether or not it would be desirable to place the following questions on the agenda of a future Session of the Conference:

- (a) the problem of the safety of workers in the building industry;
- (b) the special question of scaffolding.”

In view of this resolution the Office decided to appoint an expert to undertake enquiries on the spot in a number of countries, and thanks to the courtesy of the Ministry for Social Affairs and of the General Inspectorate of Labour of the Netherlands it was able to secure, for this purpose, the services of Mr. N. C. Winkel, Factory Inspector, The Hague.

Under instructions from the Office, Mr. Winkel carried out enquiries on the spot in Belgium, France, Great Britain, Hungary, Italy, the Netherlands and Rumania, and in all these countries he received the most valuable assistance from the factory inspectorates, employers' and workers' organisations, and safety associations.

Mr. Winkel's enquiries were mainly concerned with practical safety measures on buildings under construction, and in particular with the erection, protection and use of scaffolding, etc., and with building hoists.

At its Sixty-sixth Session (April 1934) the Governing Body proceeded to a preliminary examination of the questions which might be placed on the Agenda of the 1936 Session of the International Labour Conference and provisionally selected, *inter alia*, the question of “Safety provisions for workers in the building industry (with special reference to safety of scaffolding and hoisting machinery) ”.

In accordance with this decision the International Labour Office was instructed to prepare and submit to the Governing Body at a later Session a report on the law and practice in the matter in the various countries.

In these circumstances the Office decided to refer the question once more to the Correspondence Committee on Accident Prevention, and to lay before the Committee at its Seventh Session, in November 1934, a preliminary report on the number and causes of accidents in the building industry in certain countries, and on the results of Mr. Winkel's enquiries.

Following upon a discussion of the preliminary report, the Correspondence Committee on Accident Prevention unanimously adopted the following resolution:

"After considering the preliminary report submitted to it at its Seventh Session, and considering that the building trades and public works present special risks which can be attenuated by suitable regulations;

"(1) The Committee notes with satisfaction that the Governing Body of the International Labour Office has provisionally included the problem of the safety of workers in the building industry among the questions under consideration for the Agenda of the 1936 Session of the Conference. It expresses the hope that this question will be definitely selected when the final vote is taken;

"(2) The Committee expresses the hope that it will be asked as soon as possible to discuss draft general regulations for this industry. The regulations should set forth the safety principles which it would be desirable to have generally applied."

Further, in case the Governing Body adopted the suggestions contained in the above resolution, the Correspondence Committee appointed a Sub-Committee, which was to be instructed, in collaboration with the Office, to draft a set of model regulations for the building industry.

At its Sixty-ninth Session (January-February 1935) the Governing Body had before it the report on the law and practice with regard to the safety of building workers in various countries, prepared by the Office under the instructions given at the Sixty-sixth Session (see above); and on the basis of this report the Governing Body definitely decided to place the question on the Agenda of the Twentieth Session of the International Labour Conference (1936), with the following wording: "Safety Provisions for Workers in Building Construction, with reference to Scaffolding and Hoisting Machinery."

At the same Session the Governing Body adopted the report of the Seventh Session of the Correspondence Committee on Accident Prevention and took note of the Committee's resolution concerning the drafting of general safety regulations for the building industry.

* * *

The resolutions and decisions referred to above form the basis on which the present report has been prepared. Part I of the report shows the number and causes of accidents to building workers in a certain number of countries; the statistics

reproduced in this part have been taken from official and other authoritative sources (accident statistics, annual reports of factory inspectorates and other authorities, reports of safety associations, etc.).

Part II contains a comparative survey of the legislation in some thirty countries relating to scaffolding and hoisting machinery on buildings under construction. Having regard to the great variety of conditions, methods of work, etc., in the building industry in the different countries it was felt that this part should be as complete as possible in order to facilitate the work of the Conference.

Part III shows the organisation and powers of the inspection authorities in different countries.

Part IV gives an outline of the safety activities of employers' and workers' organisations.

Part V sets out the conclusions drawn by the Office from the whole of the material in the report. They are concerned with the possibility of framing international regulations dealing with the safety of scaffolding and hoisting appliances in building operations. Annexed to them are a *List of Points* and a *Draft Model Safety Code for Scaffolds and Hoisting Appliances used in the Building Industry*.

The list of points is submitted to the Twentieth Session of the International Labour Conference for consideration as a basis for the consultation of Governments with a view to the final discussion and adoption of international regulations at the succeeding Session.

The first draft of the model code was prepared by the Sub-Committee of the Correspondence Committee on Accident Prevention (see above); the Sub-Committee's draft was discussed in great detail by the Correspondence Committee at its Eighth Session in October 1935, and in the light of that discussion it has been redrafted by the Office in its present form.

An appendix to the report contains a list of all the laws and regulations concerning safety in the building industry that have come to the notice of the Office, including those dealt with in Parts II and III of the report. In this list will be found the sources (official gazettes, etc.) from which the texts reproduced in the report have been taken.

Throughout the report countries are arranged in French alphabetical order.

PART I

ACCIDENT RISKS IN THE BUILDING INDUSTRY

§ 1. — Introduction

In order to form an opinion as to the need for accident prevention measures in a given undertaking or a given branch of industry, it is necessary first of all to ascertain the extent and nature of the accident risks to which that undertaking or industry is exposed.

It may therefore be useful to begin this study by giving some particulars, based on the available accident statistics and other data, of the number and causes of accidents in building and their frequency and gravity in different countries.

These particulars are given in the tables contained in the present part. They have been compiled partly from official statistics and partly from the data collected in special enquiries carried out by accident prevention associations or other similar bodies.

It is important to remember, however, that the data for the several countries *are not compiled on a uniform basis*, and therefore do not permit of *direct comparison* between country and country. This, however, may be regarded as relatively unimportant for the purpose of the present report, since it is mainly a question of comparing the accident rate in the building industry with that in other industries or with the average rate throughout industry, in order to assess the ratio of accident risks in building to those in industry generally in the country concerned.

The absence of suitable data has, however, prevented this from being done for all the countries here considered. Nevertheless, even in cases where such a comparison has proved impossible, the figures given may be of some assistance in facilitating an appreciation of the magnitude of accident risks in the building industry and the necessity of finding ways and means of reducing them.

§ 2. — Accident Statistics

GERMANY

The tables for Germany, compiled from statistics published in the *Reichsarbeitsblatt*,¹ show the number of reported, compensated, and fatal accidents, classified by causes, in the years 1930-1932 (tables I and II).

TABLE I. — ACCIDENTS IN THE BUILDING TRADE, 1930-1932

Year	Number of					Accidents per 1,000 full-time workers		
	Under-takings	Full-time workers	Accidents			Total	Com-pen-sated	Fatal
			Total	Compen-sated	Fatal			
1930	205,155	1,025,232	130,663	9,590	733	127.45 (75.51)	9.35 (4.80)	0.71 (0.39)
1931	204,004	713,235	83,559	5,925	507	117.15 (64.83)	8.31 (3.92)	0.71 (0.33)
1932	201,783	556,151	58,937	3,599	393	105.97 (60.00)	6.47 (2.85)	0.71 (0.33)

Note. — The figures in parentheses are for industry in general, excluding mines.

Table I shows that in Germany the accident frequency rate in the building trade is much higher (sometimes more than double in the case of compensated and fatal accidents) than in industry as a whole, excluding mines. A comparison with other industries reveals that in 1932 the building trade stood first as regards reported accidents, second as regards compensated accidents and third as regards fatal accidents (reckoned per 1,000 full-time workers in each case).

Among the causes of the more serious accidents, "Falls of persons" takes first place, followed by "Transport" and "Collapse; falling in, down or over of objects".

Noteworthy is the decline in the frequency of reported and compensated accidents in the three years considered (table I).

This decline, however, was not maintained in 1933. The *provisional* figures available for that year² show that while the number of full-time workers in the building industry increased by 37.78 per cent., the number of reported accidents increased

¹ No. 15 of 1932, 1933, 1934 (*Unfallursachenstatistik*).

² Die Reichsunfallversicherung im Jahre 1933. Ein statistischer Überblick. (*Die Berufsgenossenschaft*, No. 3, 1935.)

by 40.99 per cent. Thus, accidents increased rather more than full-time workers, a circumstance that must be considered as a natural consequence of the engagement of large numbers of inexperienced or unskilled hands.

TABLE II. — CHIEF CAUSES OF BUILDING ACCIDENTS

Causes	1930			1931			1932		
	Accidents			Accidents			Accidents		
	Re-ported	Com-pen-sated	Fa-tal	Re-ported	Com-pen-sated	Fa-tal	Re-ported	Com-pen-sated	Fa-tal
Power generating plant	361	32	—	335	18	1	187	7	1
Power transmission plant	399	89	35	274	56	29	155	36	19
Machine tools	4,228	645	8	2,735	378	6	2,002	230	7
Haulage machinery and equipment	2,989	277	23	1,318	157	18	763	74	11
Transport	37,775	2,205	159	24,566	1,383	93	16,910	759	78
Explosives	95	29	7	57	7	3	38	8	2
Containers for liquified or compressed gases and their accessories	55	3	1	23	—	—	23	1	—
Welding and cutting plant	235	6	4	128	2	—	90	—	—
Containers for inflammable liquids	10	—	—	13	1	—	15	1	1
Hot or corrosive substances, etc.	5,703	165	11	3,529	85	5	2,663	52	2
Collapse; falling in, down, or over of objects	17,103	1,466	116	10,098	866	102	7,037	577	47
Falls of persons	24,397	2,611	216	16,135	1,719	141	11,527	1,177	123
Hand tools	7,994	207	3	5,122	135	2	3,761	70	1
Other causes *	29,269	1,855	150	19,226	1,118	107	13,766	607	101
Total	130,633	9,590	733	83,559	5,925	507	58,937	3,599	393

* Accidents on the way to or from work, occupational diseases, etc.

AUSTRIA

The situation of the Austrian building trade as regards accidents is shown in table III, which has been compiled from the statistics published in the annual reports of the factory inspectors for 1930-1933.

TABLE III. — ACCIDENTS IN THE BUILDING TRADE AND
IN ALL INDUSTRIES ¹, 1930-1933

Year	Accidents reported		Fatal accidents		Accidents in building trade as percentage of all accidents	
	All industries	Building	All industries	Building	Accidents reported	Fatal accidents
1930 . .	42,725	7,384	231	68	17.28	29.43
1931 . .	35,330	6,817	172	39	19.30	22.68
1932 . .	26,434	4,356	153	33	16.48	21.57
1933 . .	22,861	3,473	107	17	15.49	15.89

¹ Excluding mining.

In each of the four years the building trade had the largest number both of accidents reported and of fatal cases among all the groups of industries covered by the Factory Inspectorate.

Lack of the necessary data makes it impossible to compare the frequency and severity rates in building with the average for all industries.

The classification of the accidents by causes in 1933 is shown in table IV.

TABLE IV. — ACCIDENTS, BY CAUSES, 1933

Causes	Building		All industries (except mining)	
	Number of accidents	Percentage	Number of accidents	Percentage
Prime movers and transmission machinery	14	0.4	233	1.0
Machine tools	74	2.2	3,172	13.9
Hot, corrosive, etc. substances	259	7.4	1,398	6.1
Cranes, hoists, etc.	60	1.7	283	1.2
Other transport equipment	178	5.1	1,412	6.2
Various operations	775	22.3	5,648	24.7
Hand tools	440	12.7	1,637	7.2
Sharp and pointed objects	326	9.4	2,015	8.8
Collapse, fall, etc. of objects	475	13.7	2,228	9.8
Falls of persons	672	19.3	3,337	14.6
Accidents on way to or from work, occupational diseases, etc.	200	5.8	1,498	6.5
Total	3,473	100.0	22,861	100.0

It will be seen that here again the two groups "Collapse, fall, etc. of objects" and "Falls of persons" are the most frequent causes of accidents in the building trade. The two groups between them accounted for no less than 33 per cent. of all building accidents in 1933.

CANADA

The only statistics available for Canada deal solely with fatal building accidents. The data for "buildings and structures" for 1930-1933 are shown in table V.¹

TABLE V. — FATAL ACCIDENTS IN THE BUILDING INDUSTRY, BY CAUSES, 1930-1933

Cause	1930	1931	1932	1933
Hoisting apparatus	2	—	1	—
Dangerous substances, electricity, compressed air, etc. .	9	5	3	3
Striking against objects, etc.	4	1	—	1
Falling objects	18	11	5	2
Handling of objects	—	1	1	—
Tools	1	1	—	—
Falls of persons	71	37	20	18
Others	27	13	5	2
Total.	132	69	35	26
Total of all industries. .	1,655	1,188	974	773

The number of workers employed on buildings and structures is given as 164,977 for 1931, so that in that year the number of fatal accidents per 1,000 persons employed (*not* full-time workers) was 0.42. The figures for 1933 are provisional. The reports further point out that the number of persons employed declined so sharply in 1932 and 1933 that the figure cited for 1931 is not even approximately correct for later years.

It may be added that the number of fatal accidents for the *whole of the construction industry* is given as 217 for 1931 and 124 for 1932. In 1931 construction took first place with 18.27 per cent. of all fatal accidents; in 1932 it was third with 12.73 per cent.

¹ From *The Labour Gazette*, Ottawa, March 1931, 1932, 1933 and 1934.

SPAIN

The data given in table VI for accidents in the Spanish building trade during the period 1930-1933 are taken from the *Boletín del Ministerio de Trabajo, Sanidad y Previsión*.¹ The number of workers employed is available only for 1933, and it includes all building activities, such as shipbuilding, aircraft building and "the construction of other vehicles".

TABLE VI. — INDUSTRIAL ACCIDENTS, 1930-1933

Year	Building construction		Underground construction		All building ¹		All industries	
	Accidents		Accidents		Accidents		Accidents	
	Total	Fatal	Total	Fatal	Total	Fatal	Total	Fatal
1930	26,721	73	12,856	70	45,961	150	167,750	383
1931	24,651	48	10,992	36	36,865	87	157,695	321
1932	19,379	29	10,071	31	34,259	60	139,886	272
1933	25,230	26	10,718	39	40,449	69	179,694	328

¹ Including shipbuilding, etc. (see above).

Since the number of workers in all industries was 2,842,431 and the number for all building activities was 360,288 (census of 31 December 1933), the accident frequency per 1,000 workers in employment in 1933 was as follows:

	All accidents	Fatal accidents
All industries	63.2	0.12
All building	112.4	0.19

As these frequency rates are not reckoned on the basis of full-time workers, they are not directly comparable with those of other countries, but they suffice to show that in Spain as elsewhere the accident frequency rate is much higher in the building trade than the average for all industries.

UNITED STATES

Table VII reproduces a first set of figures for the United States—those compiled by the National Safety Council as a result of investigations made in 1932 and 1933 ².

In 1932 the investigations covered 3,937 undertakings in 31 groups of industries, the number of man-hours worked in these

¹ Nos. 13-14, 1931; Nos. 32 and 34, 1933; No. 44, 1934.

² NATIONAL SAFETY COUNCIL: *Accident Facts*, 1932, p. 27, and *Accident Facts*, 1933, p. 25.

undertakings being 3,754,481,000. The construction industry was represented by 61 undertakings and 22,157,000 man-hours worked. In 1933 the enquiry covered 3,776 undertakings in 30 groups of industries, 130 being in the construction industry. The total number of man-hours worked was 3,812,954,000, of which 48,435,000 were in the construction industry.

TABLE VII. — FREQUENCY AND SEVERITY RATES OF OCCUPATIONAL ACCIDENTS, 1932-1933

Industry	1932		1933	
	Frequency	Severity	Frequency	Severity
All industries (average) . .	13.20	1.59	14.56	1.59
Construction . .	57.90	4.44	55.66	5.76

The figures in this table are the rates per million man-hours (for frequency) and the days lost per thousand man-hours (for severity).

It should be added that in 1932 construction had the highest frequency rate for any industry; in 1933 it took third place after lumbering and mining. In both years it was third in the list of severity rates, following mining and lumbering in 1932 and mining and quarrying in 1933.

The results of these enquiries are more or less in agreement with the statistics published by the State of New York for 1928 and 1929.¹ These statistics cover 156 firms (16 groups) in the New York building industry and show for the years in question an average frequency rate of 50.65 and a severity rate of 5.60 (on the same basis as the figures in table VII). The rates for actual building construction (general contractors), however, are considerably higher than the average for all undertakings, being 60.17 and 6.61 in 1928 and 67.33 and 6.87 in 1929.

With regard to the classification of accidents by causes, the National Safety Council carried out an enquiry in five of the Federal States (Illinois, 1930; New York, 1931; Maryland, 1933; New Jersey, 1932; Pennsylvania, 1932). The results are reproduced in table VIII.

¹ U. S. DEPARTMENT OF LABOR (Bureau of Labor Statistics, Bulletin 541): *Handbook of Labor Statistics*, 1931 edition.

TABLE VIII. — OCCUPATIONAL ACCIDENTS, CLASSIFIED
BY CAUSES

Causes	Building industry (per cent.)	All industries (per cent.)
Handling objects	26.8	25.9
Falls to a different level	14.9	8.7
Falls on the same level	9.6	9.5
Machinery	7.5	12.0
Vehicles	6.0	10.9
Using hand tools	7.9	7.6
Falling objects	11.1	8.7
Stepping on or striking objects . .	6.5	5.6
Electricity, explosives, heat	2.7	3.6
Harmful substances	2.6	2.1
Others	4.4	5.4
Total	100.0	100.0

The above-mentioned publication of the Bureau of Labor Statistics also contains a table showing the frequency and severity of accidents in the New York building construction industry in 1929, classified by causes (table IX).

TABLE IX. — FREQUENCY AND SEVERITY OF ACCIDENTS IN THE
NEW YORK BUILDING CONSTRUCTION INDUSTRY, BY CAUSES, 1929

Cause of injury	Frequency (per cent.)	Severity (per cent.)
Handling objects	26.46	10.61
Stepping on or striking against objects	19.20	2.18
Falls of persons	19.08	37.36
Falling objects	16.83	26.76
Machinery	5.67	19.41
Miscellaneous	5.14	0.84
Hand tools	5.02	2.50
Explosives	1.77	0.29
Poisons	0.83	0.05
Total	100.00	100.00

It is thus clear from both these sets of figures that the most frequent cause is the handling of objects and by far the most serious causes are falls of persons and falling objects. The high

accident rates for machinery are also noteworthy as indicative of the advanced degree of mechanisation in the American building trade.

FRANCE

In table X the figures for building accidents in the period 1929-1932 are taken from statistics published annually under the title "Probable Consequences of Reported Accidents by Occupational Groups".¹ The figures for 1933 and 1934 were communicated by the French Government.

TABLE X. — CONSEQUENCES OF REPORTED BUILDING ACCIDENTS

Year	Fatal accidents	Incapacity		Consequences unknown	Total
		per- manent	temporary for more than four days		
1929	609	735	136,380	935	138,659
1930	709	776	148,700	1,155	151,340
1931	602	752	129,638	1,104	132,096
1932	528	714	120,571	1,365	123,178
1933	486	654	105,448	762	107,350
1934	444	594	93,671	805	95,514

As the number of workers employed is not stated, it is impossible to draw any conclusions as to the frequency or severity of the accidents. Information on these points is given in the following extracts from a recent publication of the *Syndicat Général de Garantie des chambres syndicales du bâtiment et des travaux publics*.²

Number of accidents. The average number of accidents per 1,000 full-time workers (i.e., those employed the whole year—about 270 days, after deducting holidays and days of bad weather) was:

- (a) 0.81 fatal accidents;
- (b) 8 accidents causing permanent invalidity (loss of an arm, a finger, an eye, etc.);
- (c) 220 accidents causing temporary incapacity for work with no permanent disablement.

¹ *Bulletin du Ministère du Travail et de la Prévoyance sociale*, 1931, p. 34; 1932, p. 186; 1933, p. 161; and 1934, p. 134.

² *Prévention des accidents du travail dans les travaux de maçonnerie*. Syndicat général de Garantie des chambres syndicales du bâtiment et des travaux publics. Chambre d'apprentissage de la maçonnerie, du béton armé, et de la Fédération industrielle des matériaux de construction. Paris, 1934.

Duration of incapacity for work. The duration of temporary incapacity for work, during which the worker draws compensation equal to half his wage, is on the average about 103 days in cases leading to permanent disablement and 15 days in other cases. In the following table the accidents are classified according to the duration of incapacity for work.

TABLE XI. — DURATION OF INCAPACITY FOR WORK

Permanent invalidity	Per cent.	Temporary invalidity	Per cent.
Up to 60 days	25	Up to 4 days	4
From 61 to 100 days. .	36	From 5 to 10 days . .	25
„ 101 „ 150 „ . .	25	„ 11 „ 15 „ . .	37
„ 151 „ 200 „ . .	7	„ 16 „ 20 „ . .	15
„ 201 „ 300 „ . .	4	„ 21 „ 30 „ . .	11
Over 300 days	3	Over 30 days	8
Total	100	Total	100

TABLE XII. — ACCIDENT CAUSES

	Fatal accidents (per cent.)	Permanent invalidity (per cent.)	Temporary invalidity (per cent.)
Fall of persons.	45	34	31
Fall of objects.	2	4	8
Handling of objects.	8 ¹	24	48
Hand tools.	—	3	2
Foreign bodies in eye.	—	6	6
Colliding, slipping, etc.	3	3	1
Collapse, etc.	4	4	2
Machinery	9	10	—
Electricity	2	1	—
Falling earth, etc.	5	2	1
Transport ²	14	9	—
Miscellaneous ³	8	—	1
Total	100	100	100

¹ Including 5 per cent. due to slight wounds which proved fatal as a result of infection.

² Motor cars and lorries, horse-drawn and other vehicles, trolleys.

³ Suffocation, drowning, fires, sunstroke, explosives.

GREAT BRITAIN

The annual reports of the Chief Inspector of Factories contain statistics of the causes of accidents reported as occurring in connection with the construction or repair of buildings. The figures for 1932 and 1933 are reproduced below (tables XIII and XIV).

These figures differ from those for other countries, such as France, Germany, etc., in that they refer only to building construction.

TABLE XIII. — ACCIDENTS AT BUILDINGS IN COURSE OF
CONSTRUCTION AND REPAIR, 1932: CAUSATION

Causation	Due to breakage or defect of plant		Due to other causes		Total	
	Fatal	All	Fatal	All	Fatal	All
1. Falls of persons . . .	19	140	57	658	76	798
2. Falls of articles or plant	1	7	6	332	7	339
3. Cranes and other lift- ing appliances . .	3	16	3	73	6	89
4. Other machinery . .	—	4	—	36	—	40
5. Electricity, burns, scalds, explosions .	—	3	—	35	—	38
6. Stepping on or strik- ing against objects	—	—	3	240	3	240
7. Handling articles without machinery	—	5	—	360	—	365
8. Use of hand tools .	—	3	1	225	1	228
9. Transport	—	—	—	27	—	27
10. Miscellaneous . . .	1	1	1	146	2	147
Total	24	179	71	2,132	95	2,311

Note. — In the annual reports of the Chief Inspector, groups 1, 2, 3, 4 and 7 are subdivided into a number of headings which it has not been thought necessary to reproduce here.

TABLE XIV. — ACCIDENTS AT BUILDINGS IN COURSE OF
CONSTRUCTION AND REPAIR, 1933: CAUSATION

Causation	Due to breakage or defect of plant		Due to other causes		Total	
	Fatal	All	Fatal	All	Fatal	All
1. Falls of persons . .	10	97	53	595	63	692
2. Falls of articles or plant	—	3	8	286	8	289
3. Cranes and other lift- ing appliances . .	1	12	3	46	4	58
4. Other machinery . .	—	3	—	42	—	45
5. Electricity, burns scalds, explosions .	—	—	—	16	—	16
6. Stepping on or strik- ing against objects.	—	6	2	185	2	191
7. Handling articles without machinery	—	—	—	335	—	335
8. Use of hand tools . .	—	2	—	181	—	183
9. Transport	—	—	—	12	—	12
10. Miscellaneous . . .	1	2	2	113	3	115
Total	12	125	68	1,811	80	1,936

These data may be supplemented by the results of an enquiry made by the National Employers' Mutual General Insurance Association, Ltd.¹ This enquiry covered 300 building firms employing on an average 14,136 workers. The number of man-hours worked was 28,051,058. The number of lost time injuries amounted to 1,150, of which 8 were fatal and 35 caused permanent disablement. The number of working days lost through these accidents was 85,079.

Table XV shows the number of accidents attributed to the various causes, and also the frequency and severity coefficients.

TABLE XV. — NUMBER, FREQUENCY AND SEVERITY OF ACCIDENTS,
CLASSIFIED BY CAUSES

Causes	Number of		Accidents per million man-hours (frequency rate)	Days lost per thousand man-hours worked (severity rate)
	Accidents	Working days lost		
Handling of objects. . .	347	16,105	12.37	0.57
Falls of persons. . . .	187	38,375	6.67	1.36
Stepping on or striking against objects. . . .	167	2,012	5.95	0.07
Falling objects. . . .	162	12,644	5.77	0.45
Using hand tools . . .	105	4,365	3.74	0.16
Machinery.	64	9,551	2.28	0.34
Poisonous and corro- sive substances. . .	27	486	0.97	0.02
Miscellaneous	91	1,541	3.24	0.06
Total	1,150	85,079	40.99	3.03

HUNGARY

The following figures (table XVI), taken from the annual reports of the Hungarian National Social Insurance Institution, show the accident figures for the building trade compared with those for industry in general for the years 1931 and 1932.

¹ See: *Accident Prevention in the Building and Allied Trades*. Published by the National Employers' Mutual General Insurance Association, Ltd., London, 1933.

TABLE XVI. — ACCIDENTS IN THE BUILDING TRADE AND IN
INDUSTRY IN GENERAL, 1931-1932

Industry	Year	Number of full-time workers	Accidents reported		Fatal accidents	
			Total	Per 1,000 full-time workers	Total	Per 1,000 full-time workers
Building construction	1931	23,332	1,713	73.3	17	0.73
	1932	15,973	1,603	100.4	16	1.00
Specialised building trades	1931	14,066	551	39.2	10	0.71
	1932	9,117	435	47.7	4	0.44
Building repair work	1931	8,212	469	57.1	7	0.85
	1932	8,672	346	39.9	5	0.58
All industries . . .	1931	725,679	23,483	32.4	184	0.25
	1932	665,598	22,616	34.0	136	0.20

It is clear from this table that in Hungary also the accident frequency rate in the building trade is far above the average for all industries. This is particularly true of the undertakings classified under "Building construction", but it also holds good, especially as regards fatal accidents, for the other groups.

With regard to the causes of accidents, it may be noted that in the two years under consideration almost 40 per cent. of all the accidents in the building trade were due to the two groups of causes: "Collapse and fall of objects" and "Falls of persons". In the "Building construction" group, these causes were responsible for 45 per cent. of the accidents. The fact that the group "Hoists, cranes, etc." caused only about 2 per cent. of the accidents, even in "Building construction", is presumably due mainly to the fact that these appliances are comparatively little used. Another noteworthy point is that in 1932 over 10 per cent. of all the accidents were due to "Projecting nails and sharp or pointed objects".

JAPAN

Statistics of accidents in the building industry have been compiled annually since 1932 under the Act concerning the relief of workers in case of accident. The following table shows the accidents reported in 1934, classified by causes.

TABLE XVII. — ACCIDENT STATISTICS IN THE BUILDING INDUSTRY IN JAPAN — 1934

Cause	Building			Demolition of buildings			Bridge work		
	Death	Serious injury	Slight injury	Death	Serious injury	Slight injury	Death	Serious injury	Slight injury
Machines { Gear wheels, belts Pile-driving Saws Cranes, hoists Others	4 4 — 9 —	56 79 40 162 132	19 30 11 96 68	— — — — —	— — — 1 —	— — — 1 —	— — — 1 —	24 6 2 29 18	7 6 — 19 12
Hand tools { Derailment, overturning, collisions Touched or killed by Falling from Others	1 1 4 1 —	188 158 137 16 103	180 95 98 9 87	— — — — —	— — — — —	3 — — — 1	— — 2 — —	23 32 31 2 10	26 22 13 1 8
Transport equipment { Scaffolds Upper storeys Piers or wharves, foot bridges Others	28 3 5 31	803 74 87 529	365 45 53 206	— — — —	— — — —	1 1 — —	2 2 6 —	75 — 21 78	27 — 5 18
Falls from { Objects being hoisted Others	3 5	49 403	25 438	— —	— —	1 1	— —	4 40	4 22
Falling objects { Striking against objects Objects being conveyed or handled	1 2	59 809	72 704	— 1	— —	3 2	— —	13 131	8 40
Flying objects { into eyes into other parts of body	— —	49 50	145 62	— —	— —	2 2	— —	4 6	3 6
Falls or collapses of earth or sand	3	59	23	—	—	—	1	21	6
Falls or collapses of buildings, materials or goods	13	232	115	—	—	—	3	33	17
Stumbling, slipping, overturning	2	329	308	—	—	1	—	42	35
Sharp objects	—	169	271	—	—	—	—	12	21
Hot substances	—	57	34	—	—	—	—	2	1
Gunpowder and explosions	1	5	7	—	—	—	—	—	—
Electricity	7	25	13	—	—	—	1	—	2
Others	6	204	250	—	—	1	1	23	23
Totals	128	5,063	3,829	1	26	24	19	682	352

NETHERLANDS

Accident statistics are published annually in the Netherlands by the National Insurance Bank (*Rijksverzekeringsbank*).¹ Separate figures are given for the construction industry as a whole and for various branches. Tables XVIII and XIX reproduce the statistics for building construction for 1931 and 1932. For purposes of comparison, the figures for the construction industry as a whole and for all industries have been added.

TABLE XVIII. — COMPARISONS OF ACCIDENT FIGURES IN BUILDING CONSTRUCTION, IN CONSTRUCTION IN GENERAL AND IN ALL INDUSTRIES, 1931 AND 1932

	1931			1932		
	Building construction	Construction in general	All industries	Building construction	Construction in general	All industries
Full-time workers	49,444	191,800	1,265,513	32,722	166,331	1,126,054
Accidents:						
with less than 3 days' incapacity	3,061	9,083	41,201	1,938	7,010	34,506
with 3 days' - 6 weeks' incapacity.	9,863	28,365	110,525	6,043	23,001	90,807
with over 6 weeks' incapacity.	830	2,416	8,668	555	2,066	7,554
Fatal accidents	31	96	358	21	69	282
Total . .	13,785	39,960	160,752	8,557	32,146	133,149
Accidents per 1,000 full-time workers	278.8	208.3	127.0	261.5	193.2	118.2
Fatal accidents per 1,000 full-time workers ¹ .	0.63	0.50	0.28	0.64	0.41	0.25

¹ Calculated by the International Labour Office for purposes of comparison.

¹ *Ongevallenstatistiek, betreffende het Kalenderjaar...* Samengesteld ter Voldoening aan de Bepaling von Artikel 9 der Wet op het Rijksverzekeringsbank.

This table shows that accident frequency (all accidents) in the construction industry as a whole in the Netherlands is about 65 per cent., and in building construction about 120 per cent., above the average for all industries. In the case of fatal accidents the ratio is still higher.

Table XIX, referring to the same two years, shows the causes of the accidents in building construction and in construction in general. The figures in this table refer only to undertakings with no approved medical service—a restriction that is of no practical importance.

TABLE XIX. — ACCIDENTS IN BUILDING CONSTRUCTION AND IN CONSTRUCTION IN GENERAL, BY CAUSES, 1931 AND 1932

Causes	Number of accidents			
	1931		1932	
	Building construction	Construction in general	Building construction	Construction in general
1. Prime movers and machine tools	676	1,976	357	1,346
2. Transport	2,780	9,727	1,697	8,538
3. Explosions and fires, except causes included under 4 .	12	112	11	76
4. Autogenous and electric welding and cutting, and use of acetylene generators	10	150	4	104
5. Poisonous, burning and corrosive substances, except causes included under 4 .	354	1,520	215	1,027
6. Electricity	6	37	8	22
7. Falls of persons, except causes included under 1 .	2,635	7,291	1,579	5,841
8. Nails, chips, splinters, striking against objects . . .	3,110	7,686	1,924	5,473
9. Falling objects	859	1,833	536	1,358
10. Collapse of structures . . .	340	820	187	475
11. Work with equipment other than tools or appliances .	278	1,037	183	897
12. Hand tools	2,087	5,625	1,299	4,647
13. Animals	4	79	10	101
14. Occupational diseases . . .	3	19	—	5
15. Other causes	548	1,779	485	1,960
16. Unknown causes	83	236	62	250
Total	13,785	39,927	8,557	32,120

POLAND

Statistics of the accidents in the Polish building trade and their consequences are published in the annual reports of the Factory Inspectorate,¹ from which the following figures for 1930-1932 are taken.

TABLE XX. — NUMBER OF WORKERS AND NUMBER OF ACCIDENTS, BY CAUSES, IN THE BUILDING TRADE, 1930-1932

	1930	1931	1932
Number of workers	54,594	41,761	27,202
<i>Accident causes:</i>			
Wood-working machines	20	21	17
Other machine tools	9	13	4
Hand-driven machines	8	2	10
Cranes and hoists	40	25	15
Electric wiring	10	7	8
Explosives	9	3	10
Poisonous, hot and corrosive substances	58	53	19
Collapse of scaffolding; falling objects	485	311	235
Falls of persons	411	313	196
Loading and unloading	393	242	195
Vehicles and animals	111	77	62
Transport by rail	58	37	29
Hand tools	184	161	125
Other causes	452	319	271
Total	2,248	1,584	1,196
<i>Including:</i>			
Fatal accidents	71	42	30
Accidents causing more than 4 weeks' invalidity	441	353	271
Fatal accidents per 1,000 workers	1.30	1.01	1.10

SWEDEN

The Swedish National Insurance Office publishes annual accident statistics,² from which are taken the following figures for 1930 and 1931 referring to large undertakings (excluding State undertakings).

¹ *Aperçu sur l'inspection du travail en Pologne, 1930, 1931, 1932.*

² *Ölycksfall i arbete år*, av Riksförsäkringsanstalten. (Sveriges officiella Statistik. — Socialstatistik.)

TABLE XXI. — FULL-TIME WORKERS AND INDUSTRIAL ACCIDENTS,
1930-1931

	1930	1931
A. — <i>Number of full-time workers:</i>		
1. All industries.	1,061,017	1,024,683
2. Construction in general . . .	66,227	70,233
3. Building construction	23,228	20,956
B. — <i>Number of accidents:</i>		
1. <i>In all:</i>		
(a) All industries.	104,009	92,825
(b) Construction in general. . .	9,213	10,617
(c) Building construction . . .	3,282	3,023
2. <i>Cases of invalidity:</i>		
(a) All industries.	2,255	1,891
(b) Construction in general. . .	294	301
(c) Building construction . . .	85	85
3. <i>Fatal cases:</i>		
(a) All industries.	411	311
(b) Construction in general. . .	48	51
(c) Building construction . . .	15	17
C. — <i>Accident rates:</i>		
1. <i>Accidents per 1,000 full-time workers (frequency):</i>		
(a) All industries.	98.0	90.6
(b) Construction in general. . .	139.1	151.1
(c) Building construction . . .	143.0	144.3
2. <i>Days lost per full-time worker (severity):</i>		
(a) All industries.	8.20	6.84
(b) Construction in general. . .	16.16	15.78

These figures show that in Sweden also the accident frequency and severity rates in the building trade are much higher (the severity rate being almost double) than the average rates for all industries together. In the two years covered by these statistics building came seventh and sixth on the list of industries in respect of accident frequency and third in respect of severity.

The frequency rate for building construction is approximately the same as for construction in general. The severity rate for building construction cannot be calculated separately, as the invalidity percentages are not given for sub-groups, but the available data suggest that the figure would be about the same as for construction in general.

SWITZERLAND

The Swiss Accident Insurance Institution, Lucerne, recently published a detailed report¹ on its accident statistics for the

¹ Schweizerische Unfallversicherungsanstalt: *Ergebnisse der Unfallstatistik der dritten fünfjährigen Beobachtungsperiode 1928-1932*. Lucerne, 1934.

period 1928-1932. The report contains, in addition to the data for these years, detailed information as to the number, causes and consequences of accidents in the building trade in the periods 1923-1927 and 1931-1932. A selection from these statistics, together with some supplementary figures kindly supplied by the Accident Insurance Institution, will be found below (tables XXII-XXIV).

TABLE XXII. — NUMBER AND CONSEQUENCES OF BUILDING ACCIDENTS, 1923-1927 AND 1931-1932

Groups	Number of			Acci- dents per 1,000 full- time workers	Days lost per full- time worker
	Full- time workers	Acci- dents	Days lost		
<i>1923-1927:</i>					
Underground construction	100,557	33,422	3,746,212	332.4	37.25
Building construction . .	126,638	38,893	4,019,042	307.1	31.74
Specialised building trades	86,820	21,710	2,392,152	250.0	27.55
<i>1931-1932:</i>					
Underground construction	54,644	19,208	2,150,438	351.5	39.35
Building construction . .	84,637	31,401	2,793,971	371.0	33.01
Specialised building trades	40,728	11,950	1,192,556	293.4	29.28

TABLE XXIII. — COMPARISON OF ACCIDENT FIGURES FOR BUILDING WITH THOSE FOR ALL INDUSTRIES, 1928-1932

	Under- ground construc- tion	Building construc- tion	Specialised building trades	All industries
Number of full-time workers .	205,193	205,681	98,768	3,489,003
Accidents notified	55,921	74,167	27,959	549,648
Number of cases of invalidity .	1,692	2,146	798	17,932
Number of fatal cases	261	182	96	1,688
Accidents notified } per 1,000	272.5	360.6	283.1	157.5
Cases of invalidity } full-time	8.2	10.4	8.1	5.1
Fatal cases } workers	1.2	0.9	1.0	0.5
Number of days lost	6,346,158	7,041,595	2,803,152	55,586,933
Number of days lost per full- time worker	30.9	34.2	28.4	15.9

Table XXII shows that both the frequency and the severity of the accidents in the Swiss building trade have increased in recent

years. Particularly striking is the rise of about 21 per cent. in the frequency rate for building construction.

This circumstance led the Accident Insurance Institution to make careful investigations into the causes. One of the conclusions reached was that the increased risk was a phenomenon concomitant with the quite extraordinary development in the intensity of the work,¹ and as proof of this is advanced the fact that in the period 1927-1932 there was an increase of 41 per cent. in the number of accidents with machinery in building construction, whereas the corresponding figure for other industries showed a decline.

Table XXIII shows that both the frequency and the severity rates are about 100 per cent. higher in the building industry than the average for all industries together. It also reveals that building construction is the construction group in which accidents are most frequent and most severe.

The relative importance of the various causes of accidents is shown in table XXIV.

TABLE XXIV. — CAUSES OF ACCIDENTS IN THE BUILDING INDUSTRY ¹

Causes	1923-1927		1931-1932	
	Number of accidents per 1,000 full-time workers		Number of accidents per 1,000 full-time workers	
	In under-ground construction	In building construction	In under-ground construction	In building construction
Tools; various operations . .	44.8	44.5	78.3	91.4
Raising and moving heavy objects by hand; falls of persons; falling objects, etc.	201.3	201.6	166.7	190.6
Prime movers and machine tools	4.1	3.7	8.1	6.5
Mechanical conveyers.	7.0	5.5	10.2	8.6
Decauville railways	29.9	9.8	25.0	6.9
Transport.	4.8	3.8	18.9	11.1
Hot, corrosive and explosive substances	10.6	7.3	9.6	9.0
Splinters	15.7	13.8	12.9	12.3
Occupational diseases, etc. . .	9.1	7.2	11.6	12.2
Miscellaneous	5.1	9.9	10.2	22.4
Total	332.4	307.1	351.5	371.0

¹ Excluding the group of specialised building trades, for which no information as to causation is available.

¹ Page 21 of the report cited.

One of the most striking features is the great increase in the frequency of accidents under the head "Tools; various operations" (about 105 per cent.) and accidents caused by machines, mechanical conveyors, and transport.

There has, on the other hand, been a decline in the frequency rate since 1923-1927 in the group "Raising and moving heavy objects by hand; falls of persons; falling objects, etc.", although it is still responsible for about half the accidents in the later figures. With regard to accidents caused by falls of persons, the report mentions that about half of them are due to falls from scaffolding, staging, ladders and stairs.

Scaffolding alone was responsible for 16.3 per cent. of all accident-compensation costs; the nature of the different cases, as reported to the Accident Insurance Institution in 1931 and 1932, is shown below.

	Number of accidents
Bringing up and removing scaffolding material	592
Erection and demolition of scaffolding	903
Fall of objects from scaffolding	122
Fall of persons from scaffolding	794
Persons falling on the scaffold platform	132
Collapse of scaffolding or parts of scaffolding	340
Various	19
Total	<hr/> 2,902

In view of these figures, the Institution points out that the erection of adequate scaffolding and constant supervision after its erection are the first essentials in the prevention of building accidents.

PART II

LEGISLATION

INTRODUCTION

In this Part an analysis is presented of the regulations applying (a) to various types of scaffolds and their accessories, and other means of protection against falls of men and materials, and (b) hoisting appliances used in the building trades.

The countries and territories included in this analysis are not the only ones possessing legislation on these subjects. In the first place considerations of space have made it impossible to include all the regulations of federal States such as Australia, Canada, Switzerland and the United States, and accordingly for these States only selected regulations have been dealt with. In making the selection the Office has aimed at presenting the most comprehensive texts, but has given due regard to their modernity and representative character. For *Australia* the States of New South Wales, Queensland and Western Australia have been chosen; for *Canada*, Alberta, Manitoba, Ontario and Saskatchewan—provinces which have many regulations in common; for *Switzerland*, Geneva and Zurich (City),¹ one from French and the other from German Switzerland, and both possessing regulations at once recent and detailed; and for the *United States*, California, Ohio, Pennsylvania and Wisconsin.

Other countries omitted from the analysis are those which as far as the Office is aware have no detailed regulations on the safety of scaffolds and building hoists, but nevertheless include the building industry in general safety legislation. These countries are Cuba, the Dominican Republic, Ecuador, Greece, Guatemala, Nicaragua, Paraguay and Peru.

In *Cuba*, a Decree of 29 April 1928 to issue regulations under the Act of 12 June 1916 respecting compensation for industrial accidents, requires employers to notify the Secretariat for Agriculture, Com-

¹ Scaffolding only.

merce and Labour whether they have installed the safety devices specified in the second schedule to the regulations. For the building industry these safety devices include iron hooks fixed below the eaves and capable of supporting four men; similar hooks on the roof ridges and the cornices above courtyards; iron rings for dangerous work on chimneys; pole or suspended scaffolding with hand rails; fibre nets to be spread under men doing dangerous work; ladders giving access to scaffolds and protection against falls.

In the *Dominican Republic* a Departmental Order, No. 3 of 20 November 1932, issued under Act No. 385 of 11 November 1932 concerning industrial accidents, gives lists of the safety devices required in various industries. For the building industry these devices include scaffoldings, centerings, etc., and machinery properly adapted to them; hoists and gangways properly constructed and provided with safeguards for the prevention of falls, etc.

In *Ecuador* an Act of 4 March 1927 respecting the prevention of industrial accidents lays down that scaffolding exceeding three metres in height on houses under construction or repair, or other similar work, shall be provided on each side with a guard rail not less than 90 centimetres high.

In *Greece* an Act of 19 November/2 December 1911 lays down general safety regulations for industry and in particular requires scaffoldings to be made safe in every respect.

In *Guatemala*, a Labour Protection Act of 21 November 1906 requires employers to take precautions for the prevention of accidents and to make these precautions known by written instructions posted up in a visible position in the undertaking.

In *Nicaragua* an Act of 13 May 1930, concerning industrial accidents, which applies to building operations, provides that the Ministry of Public Works shall compile and publish a list of safety devices, and shall issue regulations and instructions for the prevention of industrial accidents and respecting the conditions of employment and safety indispensable in each industry.

In *Paraguay* an Act of 7 September 1927 respecting industrial accidents, which applies to the construction, maintenance and repair of buildings, lays down that "the Executive shall issue the regulations required for the administration of this Act and other measures for the prevention of industrial accidents, and the measures for safety and hygiene necessitated by the nature of the undertakings covered by this legislation". (Sec. 26.)

The *Peruvian* Decree of 4 July 1913, regulating protective measures in industrial establishments, specifies the principal mechanical equipment that requires protection and the various precautions to be taken in various industries.

As regards building construction, mention is made of machine protection, scaffolding, hoisting appliances, and iron hooks fixed below the eaves, or on the cornices above courtyards, iron rings for dangerous work on chimneys, and fibre nets to be spread under men in dangerous positions.

In other countries again, the safety of scaffolding is a matter for the municipal or other local authorities. This is the case in *Denmark, India, Japan, the Union of South Africa and Turkey.*

Most of the scaffolding regulations analysed in this Part are quite general in scope, applying to all buildings and building operations and to the whole country. In the case of *Australia* (New South Wales and Western Australia), *Canada* (Alberta, Ontario and Saskatchewan), and *Great Britain* certain restrictions are laid down in these respects. These restrictions are as follows:

Australia

New South Wales. — The regulations apply only to the metropolitan police district and such other areas as the Governor may direct.

Western Australia. — The regulations apply to the metropolitan area and also whenever scaffolding exceeding 15 ft. in height is used.

Canada

Alberta. — The regulations concerning scaffolding and the filling in of floors do not apply to farm buildings or to work done upon a building by the owner or occupier in person.

Ontario and Saskatchewan. — The regulations concerning scaffolding and filling in of floors do not apply to any building not exceeding two storeys in height or to any farm building or to any work done upon a building by the owner or occupier in person.

Great Britain

The regulations of 1926 apply "to all premises on which machinery worked by steam, water or other mechanical power is

temporarily used for the purpose of the construction of a building, or for the purpose of any addition to the structure of an existing building. Provided that nothing in these Regulations except paragraph 45¹ shall apply to premises on which the only machinery worked by steam, water or other mechanical power consists:

- (a) of machinery which is not used for hoisting purposes and is outside the area of the building under construction, or
- (b) of portable tools such as drills or rivetters.” (R.21.6.1926: Preamble.)

Definitions of scaffolding are given in very few regulations and it has not been considered necessary to reproduce them here.

A few regulations provide for the reporting of accidents in connection with scaffolding, but only those for Geneva and Zurich specifically lay down that the scene of a serious accident shall not be disturbed until an enquiry has been held.

Provisions concerning hoisting appliances are to be found sometimes in the safety regulations for the building industry and sometimes in separate regulations for such appliances. In the latter case the regulations have not been analysed except in so far as they contain special provisions for hoists, cranes, etc., used in building operations.

In Finland, for example, more detailed rules concerning lifts and hoists are contained in a Decree of the Ministry of Commerce and Industry, dated 17 August 1933, issuing regulations for the manufacture, installation, operation, minding and inspection of lifts and hoists. By a resolution of the Council of State dated 15 February 1934 the relevant parts of this Decree were made applicable to all businesses, undertakings, and workplaces subject to the Workers' Protection Act.

The position is somewhat similar in Denmark and Russia.

The analytical method of presentation has been adopted as being particularly suitable for purposes of comparison, but the great diversity of scaffolding and hoist regulations makes any grouping of subjects a matter of some difficulty. In order to minimise overlapping and repetition in cases where regulations might

¹ Fencing of machinery, etc.

conceivably fall under more than one heading, a number of cross references have been inserted.

A list of the regulations mentioned in this Part will be found at the end of the volume.

* * *

ABBREVIATIONS

The abbreviations employed in this Part are as follows:

A.	=	Act.	Res.	=	Resolution.
D.	=	Decree.	R.D.	=	Royal Decree.
G.O.	=	General Orders.	R.O.	=	Royal Order.
N.	=	Notification.	S.C.	=	Safety Code.
O.	=	Order.	S.O.	=	Safety Orders.
O. in C.	=	Order in Council.	S.R.	=	Safety Requirements.
R.	=	Regulations.	T.P.	=	Technical Principles.

CHAPTER I

SCAFFOLDS

§ 1. — General Rules

(a) FORMALITIES FOR ERECTION

AUSTRALIA

New South Wales

Any person intending to erect scaffolding must notify an inspector of his intention, and except in emergencies must give 24 hours' notice.

(A. 26.11.1912, sec. 6.)

Queensland

Any person intending to erect scaffolding must give an inspector 24 hours' notice of his intention.

(R. 25.2.1916, sec. 4.)

Western Australia

48 hours' notice must be given.

(A. 16.1.1925, Schedule, sec. 3.)

CHILE

In the case of buildings over 12 metres in height, or of special buildings, the Directorate of Municipal Works may require the submission of plans and calculations of the scaffolds.

(R. 14.1.1930, sec. 395.)

NEW ZEALAND

As for Australia: *New South Wales*.

SWITZERLAND

Zurich

The responsible persons must notify the Scaffolding Inspectorate at the latest on beginning the building and scaffolding operations covered by the Regulations. The duty of notification also applies to the removal of scaffolds and safety devices, and to building operations in which extensive scaffolding is not erected, but mechanical devices are employed.

(R. 31.1.1931, sec. 2.)

(b) QUALIFICATIONS REQUIRED OF PERSONS ERECTING OR DISMANTLING SCAFFOLDS

AUSTRALIA

Queensland

In districts specified by the Governor General, no person may be employed or act as a scaffolder in charge of the erection or demolition of scaffolding on any building of more than one storey unless he holds a scaffolder's licence.

(A. 22.12.1915, sec. 13.)

UNITED STATES

Ohio

"Section 150. The erection, alteration and removal of all scaffolds, stagings, platforms, runways and similar equipment coming within the scope of this code shall be done under the direction and supervision of men experienced in scaffold work."

(S.R. March 1931.)

Pennsylvania

"Rule 1.

(a) The erection, alteration and removal of scaffolds shall be done under the direction and supervision of men thoroughly experienced in scaffold work . . ."

(R. 1933.)

Wisconsin

"Order 3511. General scaffold requirements. All scaffolds, and parts thereof, shall be erected, installed, maintained and inspected in accordance with the provisions of this code, and such work shall be done, and the scaffold removed, only by persons experienced in such work . . ."

(G.O. 15.7.1933.)

FINLAND

Only skilled and reliable persons may direct the erection or demolition of scaffolding.

(Res. 15.11.1927, sec. 17.)

LUXEMBURG

"6. Scaffolding shall not be erected and taken down except by persons experienced in such work . . ."

(O. 28.8.1924.)

NEW ZEALAND

No scaffolding exceeding 25 feet. in height may be erected or altered except under the supervision of a person certified by an inspector to be competent to exercise such supervision.

(A. 31.10.1922, sec. 6.)

SWITZERLAND

Geneva

"19. The erection of scaffolds shall be entrusted to skilled workers conversant with this class of work . . ."

(R. 25.3.1930.)

(c) SCAFFOLD MATERIALS AND CONSTRUCTION

GERMANY

"21. (1) In all work only good quality and suitable materials, appliances and tools shall be used.

(2) Building materials, scaffolding materials, scaffolds, . . . etc., shall be tested before use.

(3) Projecting nails, wire ends, etc., shall be immediately removed.

(4) Damaged materials, equipment, etc., shall be withdrawn from use.

45. (1) According to the nature of the work to be executed and the estimated strain, use shall be made of appropriate scaffolds erected on technical principles, and sufficiently firm, wide and extensive.

(2) The strength of the poles, ledgers, putlogs and other scaffold parts, and their distances from one another, shall be adjusted to the estimated load and strain. Lagging or poling boards shall not be employed in the erection of scaffolds.

(3) Scaffolds shall not be used before they are completely erected.

(4) Working platforms and protective covering shall be secured against being blown down.

(5)

(6) Scaffolds shall not be fastened to rain pipes, pipe clips, windows, lightning conductors or other insecure fixtures. Loose bricks and the like shall not be used as supports for scaffolds.

(7)

55.

(4) Barrels, cases, pails, piled bricks, etc., shall not be used to support scaffolds.

61. Special types of scaffolds (hanging-truss scaffolds (*Hängebockgerüste*), bracket scaffolds, patent scaffolds, etc.) shall only be used when their construction and the purpose for which they are intended have been fully approved by the Executive of the Mutual Accident Insurance Association."

(R. 1.1.1930.)

ARGENTINA

" 82. Scaffolding employed in the construction or repair of buildings shall satisfy the following conditions:

(a) a minimum width of 1.20 metres;

(b) be constructed of planks, well joined together and 5 cm. (0.05) thick, with a toeboard on both sides 30 cm. (0.30) high;

(c) the standards shall have a minimum cross section of 75 mm. (0.075) by 75 mm. (0.075), shall be placed on the edge of the pavement, sunk 50 cm. (0.50) in the ground, and be spaced not more than 3 metres apart;

(d) above the level of the scaffold shall be placed two horizontal cross pieces, one at 50 cm. (0.50) and the other at 1 metre, well secured and solid;

(e) the ledgers shall be fastened with wire or with nailed hoops, and the standards shall have cleats nailed on where the ledgers rest; . . . "

(D. 14.1.1916.)

AUSTRIA

" 5. Every scaffold shall be erected with sound timber, strong enough for the purpose and with a cross section not reduced by previous use, and in a secure and competent manner as the building advances."

(O. 7.2.1907.)

BELGIUM

" 6. The erection and dismantling of scaffolds shall be effected with all the precautions required to ensure the safety of the workers.

7. Scaffolds, and in general, erections on which the workers may be required to move about or remain shall possess all desirable soundness, rigidity and stability.

The timber shall not be puttied; it shall be of good quality, in a perfect state of preservation and free from cracks or other defects liable to impair its strength. The application of paint or any other coating to hide a defect shall be prohibited.

The lashings employed to erect scaffolds shall be in perfect condition."

(R.O. 31.3.1905.)

BULGARIA

" 37. The construction of the scaffold and the materials employed shall satisfy the specifications and technical conditions laid down in this respect."

(O. 4.5.1935.)

CANADA

Alberta

" 5. In the erection, alteration, repair, improvement or demolition of any building, no scaffolding, hoists, stays, ladders, flooring or other mechanical and temporary contrivances shall be used which are unsafe, unsuitable or improper, or which are not so constructed, protected, placed and operated as to afford reasonable safety from accident to persons employed or engaged upon the building or excavation."

(Revised Statutes 1922, chap. 193, sec. 5.)

Manitoba	}	similar to <i>Alberta</i>
Ontario		
Saskatchewan		

UNITED STATES

California

" Order 1120. (a) Where required. Scaffolds, as specified in these orders, shall be provided for all work that cannot be done safely by workmen standing on permanent or solid construction, except where such work can be safely done from ladders.

(b) Lumber. All lumber used in the construction and erection of scaffolds shall be Oregon pine or material of equal strength, and such lumber shall be dressed to uniform size and shall be sound, straight grained, free from such defects as crossgrain, shakes, large and loose knots, dry rot, large checks, brashness or worm holes.

1. Inspection of lumber. All lumber shall be inspected before used and shall be capable of supporting at least four (4) times the maximum load which will be imposed upon it.

(c) Strength of nails. All nails used in the construction of scaffolds and falsework must be of ample size and length to carry the loads they are intended to support.

1. Size — minimum. No nail smaller than eightpenny shall be used in the construction of scaffolding.

2. Driven full length. All nails shall be driven full length.

3. Bent nails. The bending over of partly driven nails is prohibited.

4. Distribution. Sufficient nails must be driven in at each point of the scaffold or falsework so that it will carry all the imposed loads placed thereupon.

(d) Unsafe types of scaffolds prohibited. Barrels, boxes, loose tile, loose bricks, loose blocks or other similar unstable objects shall not be used to support scaffolds."

(S.O. 1.7.1926.)

Ohio

Materials

“ Steel

Section 22. All structural steel parts used in the construction of scaffolds, temporary facilities or protective equipment mentioned in this code, shall be of structural grade and built to conform with the 1928 specifications for steel construction as adopted by the American Institute for steel construction, and shall provide a factor of safety of not less than four (4).

Lumber

Section 23. Lumber permissible for use in the construction of scaffolds, temporary facilities or protective equipment provided for in this code, shall be reasonably straight and close grained, free from defects such as ring shakes, crossgrain, unsound or loose knots, knots of large size, knots in groups, decay or other visible defects which materially impair its strength.

Scaffolds

Section 150. The erection, alteration and removal of all scaffolds, stagings, platforms, runways and similar equipment coming within the scope of this code shall be done under the direction and supervision of men experienced in scaffold work. No alteration shall be made which will impair the required strength of the above-mentioned equipment.

Section 151. The principal members of scaffolds, runways and similar equipment shall be substantially and securely braced.

Section 152. Planks used for flooring of scaffolds, stagings, platforms, runways, and similar equipment shall be of uniform thickness and shall be laid in accordance with the provisions of section 145 ¹ of this code.

Section 153. All scaffolds, four (4) feet or over in height, coming within the scope of this code shall be provided with reasonably adequate means of access.

Section 154. Discarded packing boxes, barrels, piles of loose lumber, or other makeshift material shall not be used as supports for scaffolds. Loose bricks or tiles may be used as supports for a foot scaffold plank not exceeding eighteen (18) inches in height.

Section 155. All scaffolds, runways, temporary floors and similar equipment shall be designed to support the loads imposed upon them in such a manner that the allowable working stresses given in tables, section 23,² are not exceeded. Members of iron or steel of equal or greater strength may be used.

Section 156. Unless otherwise specified, platforms for masons and bricklayers shall be not less than four (4) feet in width, unless space will not permit.

Section 157. The platform and all supporting elements of scaffolds, runways and similar equipment shall be designed to support a minimum uniform load per square foot of platform as follows:

Load and Material Table

	lbs.	
Stone masons	75	Stone on scaffold
Stone setters 4 stories high	30	No stone on scaffold
Stone setters — all stories .	40	No stone on scaffold
Bricklayers	50	Stocked
Carpenters — miscellaneous	20	
Painters and decorators . .	20	
Stucco	30	Hod stocked.
Lathers and plasterers. . .	30	
Lathers — precast work. .		Bay must be designed to carry weight of bay, casts and men.

¹ See under § 4 (b) “ Gangways, Runs, etc. ”
² Not reproduced.

Note: If concentrated load is used at any point in the span it shall not exceed one-half ($\frac{1}{2}$) the uniformly distributed load.

Guardrails, Toeboards, Screens

Section 239. Guardrails shall be provided as follows unless otherwise specified:

(1) On platforms, runways, ramps, scaffolds and similar equipment which are ten (10) feet or more in height measured from the ground or supporting area, or that are over or adjacent to deep holes, excavations, mortar beds, railroad tracks, furnaces, fluids, vats, high tension electric wires, machinery or similar sources of danger.

(2) Around the unused sides of all openings in roofs, platforms, floors or shafts, or covering provided conforming to the requirements for temporary floors.

(3) Where spreaders are used in window or door frames such spreaders shall be substantially secured in place.

(4) Wall openings shall be protected by standard railings and toeboards or with doors or gates not less than forty-two (42) inches high extending to the bottom of the opening.

Section 240. Guardrails shall be not less than thirty-six (36) inches nor more than forty-six (46) inches in height, measured from floors to the tops of rails, with supporting uprights spaced not more than eight (8) feet on centers, and both substantially constructed of two (2) inch by four (4) inch timber. Other spacing or other material or devices may be used provided the strength, protection and practicability of the construction is equal to or greater than that above specified.

Section 241. Intermediate rails shall be not less than one (1) inch by six (6) inch boards or equivalent material unless otherwise specified.

Section 242. Intermediate rails shall be required in all locations designated in Section 239, paragraphs (1) and (2).

Section 243. Toeboards shall be provided:

(1) Around all floor and shaft openings where guardrails are required;

(2) On the open sides of runways that are adjacent to and more than five (5) feet above the floor of passageways or work spaces, or over deep holes, excavations, mortar beds, railroad tracks, furnaces, fluids, vats, high tension electric wires, machinery or similar sources of danger.

Section 244. Toeboards shall be not less than four (4) inches net in height, constructed of wood, metal or other material.

Section 245. Side screens shall be provided on all pole scaffolds over twenty (20) feet in height that are adjacent to passageways, or where workmen are employed within ten (10) feet of the base of the scaffold, and where material is piled adjacent to and higher than toeboards. Side screens shall be made of substantial expanded metal or wire netting not larger than two (2) inch mesh or other equivalent material securely fastened in place."

(S.R. March 1931.)

Pennsylvania

"Rule 1.

(a) The erection, alteration and removal of scaffolds shall be done under the direction and supervision of men thoroughly experienced in scaffold work.

(b) The thickness and width of lumber as required by these regulations shall be the usual board measure of undressed lumber.

The board measure of dressed lumber shall be based upon the corresponding nominal dimensions of rough green lumber. Dressed lumber may be used provided the decrease in dimensions does not exceed the following maximum tolerances:

Thickness:

Up to one (1) inch inclusive, to be full board measure.

Over one (1) to two (2) inches inclusive, to be not more than $\frac{7}{32}$ inch.

Over two (2) to four (4) inches inclusive to be not more than $\frac{3}{8}$ inch.

Width:

Three (3) to seven (7) inches inclusive, to be not more than $\frac{3}{8}$ inch.

Over seven (7) to twelve (12) inches inclusive, to be not more than $\frac{1}{2}$ inch.

(c) Lumber used in the construction and erection of scaffolds shall be of sap pine, long leaf yellow pine or equivalent thereof in strength and shall be sound, well seasoned (except sap pine) and free from strength reducing defects, such as knots of greater size than consistent with absolute safety, crossgrain, dip grain, shakes, large checks, brashness, rot or dote of worm holes. Hemlock shall not be used for scaffolds over thirty (30) feet in height. Hemlock, when used, shall be of larger size than that required for any other species of wood.

(d) Lumber shall be thoroughly inspected before used, and shall be capable of supporting at least four times the maximum load that will be imposed upon it. Scaffolds shall not at any time be overloaded.

(i) Nails of proper size (minimum 10 penny), of ample length and of the best quality shall be used at all times. They shall be driven full length especially in braces, and the bending over of partly driven nails is prohibited.

(k) The principal members of scaffolds shall be rigidly and securely sway braced to prevent their displacement in any direction."

(l) All scaffolds for which specifications have not been given in these regulations, and all patented or manufactured scaffolds, parts of scaffolds or scaffolding devices, and all types of scaffolds developed subsequent to the date of adoption of the regulations shall be of an approved type.

(m) Any scaffold that shall have been damaged or weakened by any cause shall be immediately repaired and workmen shall not be permitted on such scaffold until repairs have been completed."

(R. 1933.)

Wisconsin

" *Order 3503. Temporary guard railing.* A temporary guard railing shall consist of the following wood construction, or equivalent in strength and protection:

A guard rail of wood, not less than nominal 2×4 in., fastened to posts;

Posts of wood, not less than nominal 2×4 in., spaced nor more than 8 ft. center to center, fastened and braced in place;

Top of the guard railing shall be not less than 36 in., nor more than 42 in. above the working level;

Where the top of the guard railing is more than 36 in. above the working level, a second rail, not less than nominal 1×6 in., shall be placed midway between the top guard rail and the working level (or toeboard if there is one)."

" *Order 3504. Temporary toeboard.* A temporary toeboard shall consist of a wood board not less than nominal 1×6 in. resting edgewise on the working floor or platform, fastened and braced in place."

" *Order 3509. Falsework.* All falsework, as defined in Order 3502,¹ which supports workmen at any time shall comply with the requirements that apply

¹ This definition reads as follows: "By falsework is meant any construction used to support or form plastic or easily distorted parts of a structure, such as fresh concrete and

to scaffolds under this code, except that the requirements for guard rails and toeboards need not apply."

"*Order 3511. General scaffold requirements.* All scaffolds, and parts thereof, shall be erected, installed, maintained and inspected in accordance with the provisions of this code, and such work shall be done by, and the scaffold removed, only by persons experienced in such work.

All scaffolds shall be braced to prevent the lateral movement of the whole or any part thereof. The bracing of a scaffold, or any part thereof, shall be accomplished in a manner such that the full required strength of any brace shall be developed without introducing dangerous bending stresses in the member to which it is attached.

All scaffold posts shall have appropriate footing when resting on soil to prevent settlement, and shall be fastened at the bottom to prevent slipping. The placing of objects or devices, such as building tile, loose brick, boxes, barrels, loose board construction and similar material for the support of a scaffold is prohibited.

No scaffold or part thereof shall at any time be loaded or used in a manner such that the loads and stresses permitted under Order 3513¹ will be exceeded.

Every scaffold member (except floor planks or boards) subjected to bending stress shall be set in the position to resist greatest bending load."

"*Order 3512. Scaffold materials.* All wood used in scaffolds shall be of good quality, reasonably straight grained and free from weakening knots and other defects. All lumber used in scaffolds shall be surfaced on four sides to make the grain, knots and other natural features plainly visible. All timber used in the construction of scaffolds shall be of a quality equivalent to No. 1 common dimension conforming to the American Lumber Standards as published by the Bureau of Standards in Simplified Practice Recommendation R 16-29, except that 1 in. lumber used for braces only may be No. 2 common grade.

Pondosa pine and white fir shall not be used in scaffolds.

All metal used in any part of a scaffold shall conform to the Standard Specifications of the American Society for Testing Materials, as follows:

For steel, standard specifications for structural steel for buildings, serial designation A9-29.

For wrought iron, standard specifications for refined wrought iron plates, serial designation A42-18.

For cast iron, standard specifications for malleable castings, serial designation A47-30."

"*Order 3513. Scaffold design and workmanship.* All scaffolds shall be designed and built in a manner such that the unit stresses in the material of any member when under maximum loading will not exceed those specified for that material under Chapter 5, Structural Requirements, of the Building Code issued by the Industrial Commission. . .

No wheeling shall be done on scaffold platforms supported by posts which are less than nominal 4 × 4 in., or equivalent.

Scaffolds shall not be built higher than as follows:

1. Where the posts are of nominal 2 in. material, 24 ft.;
2. Where the posts are of nominal 3 in. material, 40 ft.;
3. Where the posts are of nominal 4 in. material, or better, no height limit.

No nail smaller than the following sizes shall be used in the construction of any scaffolding:

For 1 in. (nominal) boards, 8d common, or 10d double head.

For 2 in. (nominal) material, 16d common, or 20d double head.

No nail shall be subjected to straight pull in any portion of a scaffold, except as in Order 3517.²

incompletely assembled parts or members of a structure which cannot retain their permanent shape without such support, which support or form remains in place until the part or member is capable of sustaining itself and any superimposed load."

¹ See below.

² See under § 2 (f) "Bracket Scaffolds".

All nails shall be driven full length, except that in the case of double-headed nails the nail shall be driven tightly to the guard head."

(G.O. 15.7.1933.)

FINLAND

"1. All scaffolding intended for use in house building shall be kept in such condition and fitted with such safety devices and guards as to remove any risk of accidents in the use thereof.

18. The materials for scaffolding shall be suitable for their purpose, and a sufficient quantity shall be provided at the workplace. Timber shall not be so defective that the strength of the scaffolding is liable to be reduced thereby. Iron scaffolding materials shall be free from cracks, spots of rust and other defects.

Nails, bolts, screws, rails, lashings and anchoring materials, ropes and chains, fastenings and iron clamps, etc., must not have been damaged by previous use, and shall be selected with due regard to the load to be borne by them.

In the erection of scaffolding, allowance shall be made for the weight of the materials thereof at the rate of 700 kilogrammes per cubic metre, and in addition thereto the weight of the workers employed on the scaffolding and the tools and machines, building materials and other loads to be borne thereby. Further, the strain due to wind and snow and to hoists, winches and other lifting apparatus shall be taken into account."

(Res. 15.11.1927.)

FRANCE

"2. The material used in the workplaces for scaffolding, ladders, gangways, appliances for hoisting and handling, and all other mechanism and installations shall be strong enough to bear the loads and stresses to which it will be subjected. It shall be tested before use.

The employer shall provide at the workplace itself or, if this is not possible, at the head office of the undertaking a register in which workers may enter any observations they may wish to make concerning the condition of the material or the presence of any causes liable to impair its strength and, in general, concerning the observance by the employer of the provisions of the present decree.

This register, in which the employer also may enter his observations, shall be submitted to the factory inspector at each of his visits, and signed by him."

(D. 9.8.25/26.11.1934.)

GREAT BRITAIN

"1. Suitable scaffolding plant shall be provided for workmen where necessary. All scaffolding and appliances connected therewith shall be of sound material and of adequate substance having regard to the purpose for which it is to be used. The parts thereof shall be examined before use as to strength and suitability, and if found defective, shall be repaired; or if not capable of repair, shall not be used as scaffold plant.

2. Sufficient material shall be provided for, and shall be used in the construction of, scaffolds, and when in place shall not be removed until the part to be removed is no longer required for working purposes, stability, or safety.

13. Where a scaffold has not been erected by or under the superintendence of the employer whose workmen are to use it, the said employer, before allowing work to proceed thereon, and during such period as any person employed by him is engaged thereon, shall satisfy himself, either personally or by his agent, that the scaffolding is in a stable condition, and that the materials used in its construction are sound, and that the required safeguards are in position. During the usage of the scaffolding due regard shall be paid to its carrying capacity.

18. Every pole used for scaffolding shall have the bark stripped off.

19. At least one-third of the putlogs used for supporting any working platform more than 12 feet above the ground or floor shall remain in position until the scaffolding is finally removed, and one half of the number so remaining shall be securely fastened.

23. No scaffold shall be supported by a cast-iron eaves gutter."

(R. 21.6.1926.)

IRISH FREE STATE

As for *Great Britain*.

ITALY

" 1. In constructional work covered by the Act of 17 March 1898 all the necessary precautions shall be taken to guarantee the safety and immunity of the persons employed in the operations, as regards either falls of material or other objects, or absence, deficiency or defectiveness of the necessary provisional installations.

There shall also be observed, in so far as they are applicable the provisions of the other technical regulations for the prevention of accidents and of building regulations, as well as any more extensive, and more specific provisions in the building contract.

The provisions of the present regulations, even if applying to special and specific cases shall apply to all analogous, similar or assimilable cases.

2. The provisional installations, in addition to being adequate and suited to the purpose, shall be constructed of sound materials and in accordance with perfectly sound technical principles and shall be kept in a good condition as regards maintenance and strength for the entire duration of the work.

The same requirement shall apply to all working mechanism, appliances and accessories."

(R.D. 27.5.1900.)

LUXEMBURG

" 6. Scaffolding shall not be erected and taken down except by persons experienced in such work and in accordance with the rules of the trade.

Exterior scaffolding shall be erected for all new buildings and alterations. Overhand walling shall not be allowed, except in the case of brickwork, and then only if no ashlar have to be laid.

Exterior scaffolding shall not be dispensed with except when the erection thereof presents serious difficulties, or when the Government has granted exemption from the provisions laid down above owing to special circumstances which sufficiently ensure safety.

If overhand walling is inevitable, protective scaffolding shall be erected for the safety of the workers outside the building and at the level of each storey. This flying scaffolding shall be securely fastened inside the building; the width of the floor thereof shall be not less than 1.50 metres. The flooring shall be solid throughout; in addition a solid parapet 60 centimetres high shall be erected on the outer side, sloping inwards.

7. Scaffolding shall satisfy all the requirements of strength and stability. It shall be constructed of good sound wood without cracks and not weakened by previous use."

(O. 28.8.1924.)

NORWAY

" 112. Scaffolding shall be constructed of sound materials. All parts shall be of such dimensions and secured in such manner as may be necessary in view of the height of the scaffold and the purpose for which it is required."

(R. 6.10.1928.)

POLAND

"2. (1) The auxiliary installations, transport installations, protective installations, and hoisting appliances as well as the materials employed in the construction of such installations shall be in conformity with the general practice so far as concerns their nature, and with the prescribed standards so far as concerns their strength. . . .

(3) Used materials that are in a satisfactory condition may be employed in the construction of the auxiliary installations, but for the purposes of the static calculations the permissible stresses shall be reduced accordingly.

7.

(4) The use of unbarked poles or planks as materials for scaffold construction shall be prohibited.

(5) During the erection or dismantling of scaffolds, access to the place where the work is being done shall be prohibited to the public.

8. (1) When the use of a scaffold is indispensable on outside work entailing the use of heavy materials (such as ashlar), or on outside work on buildings of a height exceeding 7 metres, it shall be compulsory to erect a pole scaffold. The scaffold shall be tied to the building by means of a suitable anchorage; anchorage to unstable parts of the building (such as lightning conductors, drain pipes, windows, etc.) shall be prohibited.

(2) When the erection of a pole scaffold for the carrying out of the work mentioned in the preceding subsection encounters technical difficulties or entails expense out of proportion to the value of the work to be done, another type of scaffold may be erected subject to the approval of the competent building authority. This authority may require the choice of type to be justified from the safety standpoint and may also require a special plan of the scaffolding to be prepared and submitted, accompanied by static calculations.

(3) When the height of the building does not exceed 7 metres and heavy materials are not used in its construction, scaffolds of other types, e.g., trestle scaffolds, jib scaffolds, etc., may be erected for outside work.

9. (1) Barrels, boxes, loose material, bricks or similar objects shall not be employed in the place of scaffolds or to support a scaffold or to raise the level of the scaffold platform.

(2) Only a single tier of trestles shall be employed on scaffold platforms.

(3) The planks of scaffold platforms shall fit closely together, shall overlap and shall be firmly secured so as to prevent them from rocking or tipping. Projecting nails shall be removed.

22. The use of scaffolding of a type not provided for in the present Decree shall be allowed if in the opinion of the competent building authority it offers the necessary guarantees of safety."

(D. 23.5.1935.)

SWEDEN

"(c) Scaffolding ladders and the like shall sufficiently ensure safety with respect to their materials, construction and erection."

(A. 29.6.1912, sec. 4.)

SWITZERLAND

Geneva

5. The materials used in workplaces for the erection of scaffolding, ladders, gangways, handling or hoisting appliances and all other appliances or

equipment shall be examined by the employer before use. In particular, all timber (poles or standards, beams and planking) shall be sound.

Timber containing unnecessary nails shall not be used. The nails shall be removed whenever woodwork is taken down.

All timber that is damaged, broken, worm-eaten or rotten shall be sawn so as to cut off the defective part.

Tools, machines and accessories such as ropes, crampirons and ties shall be kept in proper condition at all times.

Adequate stocks of materials shall be kept in the workplaces at all times.

9. Work shall not be continued during a high wind unless every precaution has been taken to strengthen provisional installations and fasten or bring down objects likely to fall.

These precautions shall also be taken before any prolonged interruption of work.

19. The erection of scaffolds shall be entrusted to skilled workers conversant with this class of work; they shall examine the scaffold parts as and when they are used and throw out all defective material.

All parts of scaffolds shall be perfectly lashed together, and their strength shall be in proportion to the stresses and strains upon them.

20. Timber for scaffolding purposes shall be barked before use, except when green wood is employed.

25. If two scaffolds are close together, passage from one to the other shall be afforded only by a gangway solidly attached and provided with the regulation guard-rails. The use of loose planks shall be prohibited (see section 13¹).

32. Except in the case of party walls and walls without openings, access to scaffolds shall preferably be by way of the windows.

When ladders are necessary they shall be solidly anchored both at the bottom and at the top.

Rope and cable ladders shall be pulled taut and suspended solely by ropes and not by a rung.

Wooden ladders shall be in a good condition and shall satisfy the requirements of section 82.²

When access to scaffolds is afforded by ramps, the ramps shall comply with the requirements of section 75.³

36. The gap between any scaffolding and exterior walls, partitions or party walls shall not exceed 20 centimetres if there are no guard-rails on the wall side.

37. When undertaking painting, or repairs to outside shutters or windows, or fixing signs, etc., the contractor shall be bound to erect adequate scaffolding.

38. Except in emergencies, a scaffold or protective installation shall not be removed or altered without the express authorisation of the contractor who has constructed it.

When a scaffold is used by workers of another trade, the firm using it shall assume all responsibility."

(R. 25.3.1930.)

Zurich

"1. Before beginning . . . building construction (new construction, alterations and repairs and demolition work of any kind) the scaffolds and protective devices required for the safety of the life and health of the workers

¹ See under § 8 (d) "Rules for the Workers".

² See under § 4 (a) "Ladders".

³ See under § 4 (b) "Gangways, runs, etc. ".

and other persons, shall be erected and thereafter constantly adjusted to the progress of the building.

3. The materials and tools used for scaffolds and shoring shall be of good and suitable quality. In particular scaffold timbers, poles and boards shall be of sound timber; useless nails in scaffold timbers and boards shall be removed immediately after each occasion of use or before storing the timber. Appliances, machines and other accessories such as ropes, dogs, lashings, etc., shall be in good and utilisable condition.

The objects to be used shall be tested as to their employability before being used and shall be constantly kept in good condition. Sufficient spare scaffold material shall always be available at the building site.

22. In all building construction, for the building of the frontages outside scaffolding of adequate strength shall be erected. Instead of building scaffolds, gabbard crane scaffolds may be used; these shall be so constructed that the working scaffolds serving to replace the building scaffold can be well and securely erected. Fire walls and parts of frontages with window openings may be erected without outside scaffolds subject to special authorisation by the scaffolding inspectorate. Workers and passers-by shall be protected by catch scaffolds and protective scaffolds. In overhand walling of such parts of walls a catch and protective scaffold of stout timber shall be erected at least at every second storey."

(R. 31.1.1931.)

CZECHOSLOVAKIA

"1. In the industrial performance of constructional and excavating operations (except on bridges, tunnels and hydraulic engineering works), in particular in the industrial construction, enlargement, alteration, heightening, improvement and demolition of buildings, reservoirs, factory chimneys, street drains, water-mains and the like, streets and roads, every person authorised to carry out such work shall maintain all the plant, scaffolding, protective devices, machinery and tools in such a condition and arrange the progress of the work in such a manner that the health and lives of the employees shall not be endangered.

19. (1) All scaffolding shall be firmly and securely erected under expert supervision and shall be kept in this condition.

(2) The component parts of the scaffolding and hoisting apparatus used in building operations (standards, poles, ledgers, putlogs, braces, planks, patent suspension gear, ladders, ropes, cables, chains, pulleys, blocks and tackle, lifting gear, etc.) shall be subjected to safety tests before the erection of the scaffolding, either by the person authorised to undertake the constructional work or by the overseer appointed by him or by the general foreman as the case may be. In particular, the timber used shall be sound, strong enough for the weight that the scaffolding is expected to bear, and with a cross-section not reduced in any way by previous use. Before transport and in any case before further use of the framework, planks, etc., and likewise immediately on the removal of the scaffolding, projecting nails shall be properly hammered down or removed.

(3) The builder or other person authorised to undertake constructional work shall always supply the requisite materials for the scaffolding in sufficient quantities and in perfect condition. Cast-iron nails shall not be used. Cramps used in the erection of scaffolding shall always be hammered in so that they are under tension and not under a compressive stress.

21.

(2) Scaffolding shall not be anchored to eaves, drain-pipes, window-frames lightning conductors or other insecure objects.

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22. (1) As a rule scaffolding shall be erected at all open places on the building, and shall extend lengthwise at least 60 centimetres beyond the building, so that work at the ends of the face (plastering, fixing eaves, etc.) can be done in safety. A proper and permanent pole scaffold shall also be gradually erected as the supporting structure of a reinforced concrete building advances, even if the reinforced concrete work and the masonry and brick-laying are entrusted to separate contractors.

23. (1) If the loading is heavy or the height is unusually great, properly reinforced scaffolding shall be used; it shall be framed or bolted or otherwise suitably assembled for the purpose under expert supervision.

(2) Unloaded flooring on high independent scaffolds (scaffolds for towers, etc.) shall be secured against being carried away by the wind.

67.

(6) The materials, scaffolds, tools, plant, protective equipment, etc., used in constructional work shall always be kept in good order and perfectly fit for use. All passages, working places, etc., shall be kept in proper condition."

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

"19. The wood used for scaffolds, platforms, shoring up excavations, etc., shall be of good quality.

20. The materials, whether new or old, used for work shall not contain projecting nails or dogs; these shall be at once removed or hammered down.

78. Scaffolds and working platforms shall be constructed of good quality materials.

79. The construction of scaffolds and working platforms and the dimensions of the materials used shall satisfy the requirements of solidity and stability and comply with the provisions of the Building Regulations (sections 130, 131 and 132).¹

When the construction of scaffolding, does not comply with the said Regulations, their strength shall be checked by calculation."

(O. 5.5.1930.)

URUGUAY

"7. In places where masonry work, painting, decoration, or repairs of any kind are being carried on, the scaffolds shall be provided with safety devices that shall form the subject of regulations issued by the Executive."

(A. 21.7.1914 as amended 21.8.1935.)

"II. Construction and demolition operations shall not begin before the protective installations (scaffolding, etc.) are in order.

III. The materials of these installations shall be of good quality and suited to the purpose for which they are intended, and shall be in perfect condition."

(D. 14.4.1915, secs. II and III.)

YUGOSLAVIA

"115. When scaffolds are being erected or dismantled, the necessary measures shall be taken to ensure the safety of the workers employed thereon.

¹ Not reproduced.

All scaffolds used in connection with buildings shall be of thoroughly sound wood and shall be so constructed that they are fully able to bear the load to which they will be subjected. In the case of suspended scaffolds, the necessary measures shall be taken to ensure that the part of the building to which they are attached is strong enough to hold them and their loads. Persons underneath suspended scaffolds shall not be exposed to the danger of falling objects.

Any nails in pieces of wood used for erecting a scaffold shall be removed before use."

(R. 25.10.1921.)

§ 2. — Various Types of Scaffolds

(a) POLE SCAFFOLDS

GERMANY

"46. (1) For new construction and reconstruction, pole scaffolds shall be erected outside the exterior walls if work is to be done at a height of over 7 metres. The scaffold shall be heightened as the building proceeds.

(3) Where it is very difficult to erect a pole scaffold, a cantilever scaffold shall be erected as a protection.

(4) The topmost stage of pole or cantilever scaffolding shall not be more than 4 metres below the actual workplace.

47.

(4) With pole scaffolds on which work is done and loads are placed, when the workplace is 5 metres or more above the ground level, the stage immediately underneath shall also be completely covered over.

(5) The vertical distance between any two scaffold stages shall not as a rule exceed 2 metres.

48. (1) Scaffold poles shall be so fastened by being sunk in the ground, or by being mortised to wooden bases that they can neither sink, slip, nor be otherwise displaced.

(2) At junctions of scaffolds at corners, a corner pole shall be erected.

49. (1) If a scaffold pole is lengthened by fastening another to it, there shall be sufficient overlapping, at least 2 metres. The extension (*Pfropfstange*) shall be securely fastened by lashing. The hemp ropes, wire ropes, chains, etc., used for such lashing, or for any other purpose on scaffolds, shall be secured against slipping by stout nails, hooks, dogs, or similar appliances.

(2) The extension (*Pfropfstange*) shall rest on an adjacent double pole, or on some part of the scaffold well supported by other means.

50. (1) The ledgers shall be lashed to the scaffolding and shall also be adequately supported, having regard to the loads carried, by cleats, dogs or wooden stays; and shall remain in position all along the scaffold until it is taken down.

(2) Unsupported joints of ledgers, and overhanging unsupported flooring on scaffolds shall be prohibited.

51. (1) Scaffolding shall be anchored in the building; if this is not possible, an independent scaffolding shall be erected.

(2) Lengthwise and crosswise displacement shall be prevented by diagonal bracing fixed in position until the scaffold is taken down.

52. Putlogs shall be in one piece, securely laid, and so resting on their supports that they cannot be displaced, pulled out or turned. If lodged in

masonry, they shall be inserted at least to half a stone's depth. It shall be prohibited to lay them on projecting or insecure parts of the building. Putlogs lying on or at the ends of ledgers shall be lashed to the ledgers.

53. (1) Scaffold boards shall be squared, shall be adequately stout having regard to the load; and shall suffer no impairment of their bearing strength. The boards shall be laid close together, and in such manner that they can neither tilt nor slip.

(2) Any scaffold stage used for work or storage shall be boarded over up to the inside scaffold poles, or, failing them, as near to the wall as possible.

(3) Under every joint on scaffold stages, either two beams shall be placed side by side, or the scaffold boards shall overlap one another sufficiently and rest on a beam.

54. Scaffold stages more than 2 metres above the ground shall be provided with guard-rails and toe-boards at all places where it is possible to fall off them. The same shall apply to openings in stages on scaffolding constituting means of access, runs, open flights of stairs, landings, and places for getting on and off ladders. The guard-rails shall be fixed 1 metre above the scaffold stage."

(R. 1.1.1930.)

AUSTRALIA

New South Wales

External Scaffold for Bricklayers

"4. Standards to be not more than 9 ft. apart, and, if hardwood, not less than 4 in. diameter at butt, and $2\frac{1}{2}$ in. at tip; if sawn pine timber, they shall not be less than 16 in. sectional area. Standards to be embedded 12 in. in ground, or in barrels filled with solid material.

If cart entrance between standards is necessary, the spacing shall be not more than 10 ft.

In no instance must brick blockings be used to a greater height than 5 ft. from the horizontal base.

Ledgers to be not less than 12 in. sectional area hardwood—or 15 in. sectional area, minimum depth 5 in., if pine timber—and to be tied or bolted to standards at spaces of not more than 6 ft. apart. First ledger may be fixed at not more than 10 ft. from the ground, where circumstances require it.

Putlogs to be of hardwood; where the span does not exceed 5 ft. in the clear, the sectional area shall be not less than 9 in., spaced not more than 6 ft. apart, and to have not less than $4\frac{1}{2}$ in. bearing in wall; all putlogs to be securely wedged in position.

Scaffold boards to be closely laid, and of sound timber, not less than $1\frac{1}{2}$ in. thick, laid butting or lapping, but where lapped, the laps to be not less than 9 in. Scaffolds to have 9 in. by $1\frac{1}{2}$ in. fender board on all working stages secured to standards; also guard-rail, not less than 3 ft. high, of scaffold poles or timber, not less than 6 in. sectional area, lashed or bolted to standards or $3\frac{1}{2}$ in. manila rope. Openings through guard-rail and fender board allowed alongside landings only.

Bracing to be not less than 9 in. sectional area, hardwood poles or sawn pine timber, and placed to the inspector's satisfaction.

Scaffolds to be secured by manila rope not less than $1\frac{3}{4}$ in. in circumference and 15 ft. long, or bolts not less than $\frac{5}{8}$ in. diameter, fitted with washers. All lashings to be kept properly wedged, and bolts properly tightened up.

Foot-planks not exceeding 16 in. in height may be used subject to approval by the inspector."

(A. 26.11.1912, Second Schedule, sec. 4.)

External Scaffold for Plasterers

"6. Where an external scaffold is to be used for plasterer's work only, the standards may be spaced not more than 10 ft. apart, and, if hardwood, not

less than 4 in. diameter at butt and $2\frac{1}{2}$ in. at tip; if sawn pine timber they shall not be less than 16 in. sectional area. Standards to be embedded 12 in. in ground, or in barrels filled with solid material.

Ledgers to be not less than 4 in. diameter butt, and $2\frac{1}{2}$ in. taper end, or 12 in. sectional area, and spaced to suit the particular class of work, such spacing to be to the satisfaction of the inspector. Bracing to be not less than 6 in. sectional area."

Putlogs: (As for "External Scaffold for Bricklayers").

Scaffold boards: (As for "External Scaffold for Bricklayers").

Lashings: (As for "External Scaffold for Bricklayers").

(A. 26.11.1912, Second Schedule, sec. 6.)

Queensland

Round Hardwood Pole Scaffolding for Bricklayers, Plasterers and Others

"5. Every external and internal scaffolding for bricklayers, plasterers, and other persons engaged in such like work, shall be erected by the owner thereof according to the following specifications:

(1) Standards shall be spaced not more than 9 ft. apart, and shall be not less than 4 in. in diameter at butt, and $2\frac{1}{2}$ in. at tip; standards shall be embedded for a distance of 12 in. in ground, where practicable; and, where necessary, shall stand on a solid sole piece of hardwood 18 in. by 9 in. by 2 in.

(2) Ledgers shall be of round hardwood poles not less than $3\frac{1}{2}$ in. in diameter, and shall be securely fastened to standards at spaces not more than 6 ft. apart with manilla ropes each not less than $1\frac{3}{4}$ in. in circumference and 18 ft. in length. The first ledger may be fixed at not more than 10 ft. from ground where circumstances so require.

(3) Putlogs shall be of approved hardwood timber. Where the span does not exceed 5 ft. in the clear, the size shall not be less than 3 in. by 3 in., spaced not more than 6 ft. apart, and such putlog shall have not less than $4\frac{1}{2}$ in. bearing in the wall. All putlogs, where practicable, shall be securely wedged in position at wall and securely fastened to ledger. Alternate putlogs only may be removed from the lower stages, until scaffolding is finished with, or hoop-iron ties secured to the wall.

(4) Scaffold boards shall be of sound timber, and not less than $1\frac{1}{2}$ in. thick laid butting or lapping; where lapped, the laps shall be not less than 9 in. All scaffoldings shall have fender boards not less than 9 in. high and 1 in. thick, secured to standards on all working platforms, also guard-rail of round poles not less than 2 ft. 6 in. or more than 3 ft. high from platform secured to standards with manilla ropes, each not less than $1\frac{3}{4}$ in. in circumference and 18 ft. in length. No openings through guard-rail and fender boards shall be allowed except alongside of landing.

Bracing shall be of hardwood round poles, secured to standards with $1\frac{3}{4}$ in. in circumference manilla rope, and shall be securely placed, or placed in such a way as any inspector may direct. All lashings shall be kept properly wedged up.

(5) Where the height of a scaffolding exceeds 25 ft., double poles shall be erected from the ground, and all fender boards shall be not less than 18 in. in height.

(6) If an entrance for carts and vehicles between standards is necessary, then the spacing of such standards shall not be more than 10 ft. Under no circumstances shall brick blocking or cement casks be used on or for any part of a scaffolding.

(7) Foot planks not exceeding 12 in. in height may be used if approved by an inspector.

(8) Where barrows are used for wheeling bricks along any scaffoldings, sufficiently heavier timbers shall be used, or the putlogs placed not more than 4 ft. apart, or in such other manner as any inspector may direct."

(R. 25.2.1916, sec. 5.)

Square Sawn Pine Timber Scaffolding for Brick Building

"6. When sawn timber is used, every external and internal scaffolding for bricklayers, plasterers, and other persons engaged in such like work, shall be erected by the owner thereof according to the following specifications:

(1) Standards shall be not less than 5 in. by 3 in. or 4 in. by 4 in. clean pine, and shall be spaced not more than 9 ft. apart. Standards shall be embedded in the ground for a distance of 12 in., where practicable, and, where necessary, shall stand on solid hardwood sole piece 18 in. in length by 9 in. wide and 2 in. thick.

(2) Where standards are not in one length, such standards shall be joined with wooden fish-plate at least 6 ft. in length and 3 in. thick, well bolted together on each side of such standard with iron bolts $\frac{5}{8}$ in. in diameter and provided with washers.

(3) Ledgers shall be not less than 7 in. by 2 in. and shall be bolted to standards at spaces not more than 6 ft. apart with iron bolts $\frac{5}{8}$ in. diameter, and provided with washers. The first ledger may be fixed at not more than 10 ft. from ground, where circumstances so require.

(4) Putlogs: (As for "Round Hardwood Pole Scaffolding").

(5) Scaffold boards: (As for "Round Hardwood Pole Scaffolding" except that $\frac{5}{8}$ in. iron bolts are required instead of manilla ropes).

Bracing shall be of pine not less than 4 in. by 2 in., secured to standards with $\frac{5}{8}$ in. diameter iron bolts and washers, and shall be securely placed or placed in such a way as any inspector may direct.

All bolts shall be provided with washers and shall be kept properly tightened up.

(6) When the height of a scaffolding exceeds 25 ft., sufficiently heavier timbers must be used, and all fender boards shall be not less than 18 in. in height. Such scaffolding shall be safely erected, or erected in such a manner as any inspector may direct.

(7) Entrance for carts and vehicles, etc.: (As for "Round Hardwood Pole Scaffolding").

(8) Foot planks: (As for "Round Hardwood Pole Scaffolding").

(9) Where barrows are used for wheeling bricks along any scaffolding erected with sawn timbers, the ledgers shall not be less than 8 in. by 2 in. or 7 in. by $2\frac{1}{2}$ in., and putlogs shall be spaced not more than 4 ft. apart, or in such other manner as any inspector may direct."

(R. 25.2.1916, sec. 6.)

Scaffolding for Carpenters, Painters, Plumbers, and Others working on Wooden Buildings

"7. Every scaffolding for carpenters, painters, plumbers, and others working on wooden buildings shall be erected by the owner according to the following specifications:

(i) Standards shall be not less than 3 in. by 2 in. hardwood, or 4 in. by 2 in. pine, spaced not more than 9 ft. apart. Ledgers shall be not less than 6 in. by 1 in., well nailed to standards and to the studs of walls.

(ii) Scaffold boards shall be of sound timber not less than $1\frac{1}{2}$ in. thick laid butting or lapping; when lapping, the laps shall be not less than 9 in. The floor of platform shall be not less than 18 in. in width. Guard-rail shall be not less than 3 in. by $1\frac{1}{2}$ in. pine, securely fastened to standards at not less than 2 ft. 6 in. from platform. Braces shall be not less than 3 in. by $1\frac{1}{2}$ in. pine, well nailed to standard.

(iii) Any inspector may direct the construction of such scaffolding to be made in such manner as he in his discretion thinks necessary to make the same safe for use."

(R. 25.2.1916, sec. 7.)

Scaffoldings over 25 ft. in Height

" 8. Every scaffolding over 25ft. in height used on a wooden building shall be erected by the owner thereof according to the following specifications:

Standards shall be not less than 4 in. by 3 in. hardwood or 5 in. by 3 in. pine, and shall be spaced not more than 9 ft. apart. Ledgers shall be not less than 6 in. by 2 in. pine, well secured to standards and to walls, and spaced to suit the work required. Braces shall be not less than 3 in. by 2 in. pine, bolted to standards, or well secured to standards with nails. Guard-rail shall be not less than 3 in. by 2 in. pine, and shall be securely fastened to standards. Any inspector may direct the construction of such scaffolding to be made in such manner as he in his discretion thinks necessary to make the same safe for use."

(R. 25.2.1916, sec. 8.)

Western Australia

The regulations are the same as for *Queensland* except that when sawn timber is used for external or internal scaffolding for bricklayers, plasterers, etc., and such scaffolding is not more than 12 ft. high and the standards are in one length, are not less than 4 in. by 2 in., are placed not more than 6 ft. apart, and in other respects comply with the regulations, then ledgers not less than 4 in. by 2 in. may be used; provided that the first ledger is not more than 5 ft. above the ground level and all the ledgers are securely bolted to standards with iron bolts not less than $\frac{1}{2}$ in. in diameter with washers, and properly tightened up.

(O. in C. 24.4.1928; Regulations under Act of 6.1.1925.)

AUSTRIA

" (6) In the case of pole scaffolds the standards shall rest on a firm support and the putlogs on secure bearings; if there is lateral stress on the whole scaffold or on parts of it sufficiently strong bracing shall be erected. Special scaffolds, e.g. for towers, etc., shall be properly mortised together.

On all stages of the scaffold a suitably close-planked, strong and wide flooring shall be laid, the ends of which shall not overhang. As a protection against falls of men, materials or tools, guard-rails, and on the outside, toe-boards shall be fitted.

Communication with and between the various stages of the scaffold shall be provided by gangways, stairs and ladders but always in such manner that the scaffolds and working platforms can only be reached by breaking the ascent at every storey."

(O. 7.2.1907.)

BELGIUM

" 8. Whenever possible, scaffold uprights let into the ground shall be sunk a sufficient distance to ensure the perfect stability of the erection.

Uprights not let into the ground shall be held in position either by a footing made of plaster or by tying them together or fastening them to the wall so as to prevent any slipping.

Uprights mounted on planking (*gîtage*) shall rest on a sufficiently strong wooden sole distributing the weight over at least three planks (*gîtes*) and attached to the outside planks. In any case the uprights shall have a level supporting surface and shall rest on a flat foundation of sufficient stability and strength.

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9. The putlogs and boards shall afford all desirable security; they shall be supported, wedged and fixed so as to ensure perfect stability.

Warped boards shall be thrown out.

Boards on which workers are required to move about or remain shall also be suitably assembled; no dangerous openings shall be left between them.

10. Stout guard-rails at a suitable height, and as far as possible, adequately strong diagonal cross pieces, shall be placed so as to reinforce the scaffold and protect the workers against accidents.

The guard-rails of scaffolds on which work is done sitting shall consist of two rails, one placed so as to guide the hand of a worker walking on the boards, and the other at the height of a sitting worker's shoulder.

The obligation to provide guard-rails shall extend to the topmost platform of the scaffold."

(R.O. 31.3.1905.)

BULGARIA

"37. The construction of the scaffold and the materials employed shall satisfy the specifications and technical conditions laid down in this respect.

38. The distance between the uprights, and their dimensions, shall be determined in accordance with the weight to be borne and the space required for working.

39. Before it is used for any purpose, the scaffold shall be completed, and have been examined and approved by the person responsible for construction. The scaffold shall be examined periodically, particularly after high wind, storm or rain.

40. The scaffold shall not be fixed to gutters, lightning conductors, and other insecure objects. The use of bricks or other objects as supports or wedges shall be prohibited.

41. The uprights shall be let into the ground, or, if this is not sufficiently firm, laid on horizontal beams and firmly secured by means of dogs.

When the uprights are formed of bundles of poles, they shall be assembled by means of dogs or bolts. If two uprights are extended the joins shall not be at the same level but at levels at least 1.50 m. apart. The join itself shall extend at least 1 m.

To prevent the scaffold from coming away from the building, it shall be slightly inclined towards it.

42. The uprights shall be secured to the walls by means of putlogs; these shall be placed on cleats, which shall be fixed to the uprights by means of nails, bolts or dogs. Further, the putlogs shall be nailed to the uprights, and their ends on the wall side housed in the wall to a depth of at least 25 cm.

43. The uprights shall be tied together by means of diagonal bracing (poles or large beams).

44. The scaffold platform shall be formed of thick nailed planks; the joins between the planks shall rest on putlogs. The planks shall reach as near as possible to the wall, and the space between them shall not exceed 3 cm. The platform shall be provided with a guard-rail 1 m. high, and a toeboard at least 25 cm. high shall be nailed on to prevent workers from slipping and bricks and other objects from falling off."

(O. 4.5.1935.)

CANADA

Alberta

"(c) Where poles are used in scaffolding the poles shall be securely lashed at every point of contact, and where square timber is used in scaffolding, the same shall be securely spiked or bolted at every point of contact."

(Revised Statutes 1922, chap. 193, sec. 6.)

Manitoba	}	Similar to <i>Alberta</i> .
Ontario		
Saskatchewan		

CHILE

" 52. The scaffolds employed in the construction or repair of buildings shall satisfy the following conditions:

(a) A minimum width of 1 m.

(b) Consist of planks closely laid and 5 cm. thick with a toeboard of 30 cm. on both sides.

(c) The standards shall be at least 75 mm. by 75 mm., be placed at the edge of the pavement, be sunk 50 cm. in the ground, and be not more than 3 m. apart. If it is not practicable to sink the standards in the ground they shall be provided with sole plates to give sufficient stability to the scaffold.

(d) Above the level of the scaffold shall be placed two horizontal traverses, one at 50 cm. and the other at 1 m., well secured and solid.

(e) The putlogs shall be lashed with wire or spikes and the standards shall have cleats nailed at the points supporting the putlogs.

(f) "

(R. 30.4.1926.)

" 384. The boards, gangways and platforms of fixed scaffolds erected in public highways shall leave a clear space of at least 2.50 m. above the level of the pavement. The first floor shall be constructed of planks, not less than 0.05 m. thick, joined together, with the joints covered by cleats, and with a toeboard 0.30 m. high on both sides to prevent the fall of materials. The scaffold shall have a width not exceeding that of the pavement less 0.50 m., but shall not exceed 2 m. The length of the scaffold shall be not less than 3 m.

385. The scaffold shall be maintained in perfect condition as regards stability and preservation for the whole duration of the operations, and shall be of such form as to avoid any nuisance or prejudice to passers-by and neighbouring property.

386. The standards of fixed scaffolds for the construction of buildings not exceeding 12 m. in height shall have a minimum cross section of 0.10 × 0.10 m.; shall be suitably supported and placed at distances of not more than 3 m. centre to centre. The joining of scaffold standards shall be done end on, and reinforced laterally on the four sides by pieces of wood 1 m. long, nailed and secured with strong ropes or wired on; or by overlapping with cleats and spikes, or special lashing.

The cross section of the standards shall be increased if they are spaced wider apart. Double planks measuring at least 0.075 m. by 0.10 m. or single planks 0.075 m. by 0.15 m. shall be placed at the level of each storey to tie the standards or uprights together.

387. The putlogs shall not measure less than 0.10 m. by 0.15 m. and shall rest on cleats nailed and lashed with wire to the standards of the scaffold, or secured with spikes, special dogs, or other contrivances approved by the Directorate of Municipal Works.

The putlogs shall be fixed in the walls by means of anchor plates, wedges or special anchorages.

The floor boards shall rest with their ends on the putlogs to which they shall be lashed with rope or wire.

388. On the outside of every floor of the scaffold, but inside the standards, shall be installed two horizontal rails not less than 0.50 m. × 0.50 m.,¹ one at a height of 0.50 m. and the other at a height of 1 m., well secured to the uprights. On the first floor of the scaffold this railing shall be completely closed in by boards 1 cm. thick.

389. Scaffolds shall be braced lengthwise and crosswise.

390. The Directorate of Municipal Works may require scaffolds, etc., to be closed in, partially or entirely, with boards, canvas, etc., when the work

¹ These figures should probably be 0.05 m. × 0.05 m.

produces much dust, or there is a risk of rubbish or materials falling on the public highway.

391. The ladders serving the different floors of the scaffold shall be constructed rigidly, with the necessary solidity, shall have side railings, and be firmly secured at least at one of their ends."

(R. 14.1.1930)

UNITED STATES

California

"Order 1121."

(a) All pole scaffolds intended to be used by all trades except bricklayers, stone masons, stone cutters, concrete workers, structural steel workers and riveters, shall be constructed as follows: for heights not to exceed thirty-two (32) feet, the uprights shall be two by four (2×4) inch lumber or heavier, spaced four feet six inches ($4' 6''$) from the wall, parallel to it and not more than ten (10) feet center to center. The platform of the scaffold shall be supported by putlogs made of one by six (1×6) inch boards or heavier material, laid on edge. The ledgers shall be one by six (1×6) inches, securely nailed to the uprights directly under the putlogs so as to support same. The scaffold shall be rigidly braced throughout and every part thereof so secured as to prevent swaying, tipping or collapsing of same. The uprights of the scaffold at the bottom, when resting on a sidewalk, shall be secured to a block or sill to prevent slipping. When resting on the ground, holes four (4) inches to six (6) inches deep shall be dug to receive the foot of each upright. Whenever soft soil is encountered, the uprights shall be secured to mud sills. The platform shall be at least twenty-four (24) inches wide, and shall be made of planks at least two (2) inches thick and not less than eight (8) inches wide, laid directly upon the putlogs, and adequately secured to prevent them from slipping, tipping or collapsing.

Order 1122. Railings and Toeboards. (a) Where required. Railings and toeboards shall be provided on all open sides of scaffolds ten (10) feet or more above the ground.

(b) Construction. Railings shall not be less than forty-two (42) inches high, made of one and five-eighths by three and five-eighths ($1\frac{5}{8} \times 3\frac{5}{8}$) inch lumber, with posts every eight (8) feet, or equivalent and toeboards shall be solid and not less than six (6) inches high above top of platform except where otherwise specified in these orders.

(c) Side screens. If material on a scaffold is piled higher than the toeboard, one-half ($\frac{1}{2}$) inch wire mesh or canvas shall be provided between the railing and toeboard.

Order 1123. (a) Bricklayers', concrete workers' and stone masons' pole scaffolds for structures up to and including thirty-two (32) feet in height shall be supported by four by four (4×4) inch uprights or heavier material, spaced not greater than seven feet six inches ($7' 6''$) center to center. The platform shall be at least four (4) feet wide, constructed of planks at least two (2) inches thick, laid closely together and adequately secured, to prevent them from slipping, tipping or collapsing. The platform shall be supported by putlogs and ledgers, nailed or bolted to the uprights. Putlogs shall be made of either one piece two by six (2×6) inches, securely fastened at each point of support, or shall be two pieces one by eight (1×8) inches, one being on each side of the uprights and fastened securely at each point of support. The ledger shall be one by eight (1×8) inches securely fastened to uprights. A toeboard at least six (6) inches high shall be placed on the outside edges of all bricklayers', concrete workers' and stone masons' pole scaffolds.

(b) All bricklayers', concrete workers' and stone masons' pole scaffolds shall be adequately braced and so constructed as to prevent swaying or collapsing.

Order 1124. Built up scaffolds. (a) None but skilled workmen shall be employed in the erection of scaffolds, and the work shall be under the supervision of a man who thoroughly understands the dangers that are involved and who knows and will take such precautions as will insure safety.

(b) No scaffold shall be altered by removing uprights, braces or other supporting members, except under the supervision of the contractor or his foreman. In no case shall the strength of the scaffold be impaired.

(c) Scaffolds shall not be overloaded. Material shall not be delivered nor allowed to accumulate to such an extent as to subject the scaffold to a load which it is not intended to support.

(d) Runways or ladders shall be erected to platforms of scaffolds five (5) feet or more in height.

(e) Where a scaffold passes a wall opening five (5) feet or more above the platform of the scaffold, a two-rail railing three and one half (3½) feet high with a toeboard at least six (6) inches high shall be erected across the opening, and where openings are less than five (5) feet the toeboard only shall be provided.

Order 1125. (a) The following schedules of designs and dimensions shall be used for all scaffolds more than thirty-two (32) feet in height. Materials of different sectional dimensions may be used, but they shall be of equal strength to that given in these schedules. Spacings may be increased if the cross section of the material and the cross-bracing to be used is increased sufficiently to give strength and rigidity equal to that required by the schedules.

(b) Schedules of scaffolds more than thirty-two (32) feet in height.

	Interior	General ¹	Bricklayers	Stonemaçons
Uprights	3×4 in.	3×4 in.	4×4 in.	4×6 in.
Runners or ledgers	1×6 „	1×6 „	1×8 „	1×8 „
Bearers or putlogs	1×6 „	1×6 „	2×6 „	2×6 „
Splice pieces	1×4 „	1×4 „	1×4 „	1×6 „
Braces	1×6 „	1×6 „	1×8 „	1×8 „
Spacing uprights—longitudinal ²	10 ft.	10 ft.	7 ft. 6 in.	7 ft. 6 in.
Spacing uprights—transverse ³	10 „	4 ft. 6 in.	4 „ 6 „	4 „ 6 „
Spacing runners or ledgers—vertical	10 „	10 „	7 „ 6 „	7 „ 6 „
Railing	2×4 in.	2×4 in.	2×4 in.	2×4 in.
Toeboard	1×8 „	1×8 „	1×8 „	1×8 „
Width of platform	24 „	24 „	4 ft.	4 ft.
Planking	2 in. in thickness by 10 in. wide.			

Scaffolds over sixty (60) feet in height:

Plasterers: End posts 4×4 in.
 Bricklayers: End posts 4×6 in. half way up.
 Stone masons: End posts 6×6 in.
 Middle posts 4×6 in.

Scaffolds over eighty (80) feet in height:

General: End posts 4×4 in. half way up.
 Middle posts 4×4 in. half way up.

(c) Platforms shall be not less than one and one-half (1½) inches in thickness.

(d) When a platform is constructed of planks one and one-half (1½) inches in thickness and at least ten (10) inches in width, the distance between supports shall be not more than six (6) feet.

(e) When a platform is constructed of planks two (2) inches in thickness and at least ten (10) inches in width, the distance between supports shall be not

¹ Including carpenters', plasterers' and lathers' scaffolds.

² Parallel to direction of platform planks.

³ At right angles to platform planks.

more than ten (10) feet. All lumber shall be straight grained, sound and free from knots, shakes and other defects.

(f) The cross pieces shall be so constructed as to provide for a single plank platform for masons or bricklayers to stand upon, a double plank platform for tenders, and an elevated plank platform for holding materials.

(g) Ends, braces and cross pieces shall be bolted with bolts not less than one-half ($\frac{1}{2}$) inch in diameter and top of standards shall be banded with three by one-eighth ($3 \times \frac{1}{8}$) inch band iron.

(h) All supporting and tie bolts shall be not less than three-quarters ($\frac{3}{4}$) of an inch in diameter."

(S.O. 1.7.1926.)

Ohio

"Section 158. (a) The lower end of the poles or uprights shall rest upon a firm foundation so as to prevent the sinking of the poles and shall be secured against lateral displacement.

(b) Spliced poles shall be squared at the butt joints, made continuous and uniformly strong throughout their lengths with securely nailed or bolted cleats.

(c) There shall be not less than two cleats to each splice or joint and shall be of sound wood not less than thirty (30) inches long, one (1) inch thick and of the width of the poles, placed so as to overlap the abutting ends of each pole by not less than fifteen (15) inches and securely fastened to the poles at least on two (2) sides.

(d) Poles for scaffolds carrying loads less than thirty (30) pounds per square foot may be lap jointed, with lap not less than thirty (30) inches securely fastened.

Section 159. (a) On scaffolds where ledgers are used, ledgers shall be not less than one (1) inch thick and eight (8) inches wide, unless otherwise specified, extend over two (2) consecutive pole spaces and shall overlap the poles not less than four (4) inches. They shall be left in position to brace the poles as the platform is raised with the progress of the work.

(b) Ledgers shall be level and their top edges at the same height as the bottom openings in the wall for putlogs.

(c) Ledgers that carry heavily loaded platforms shall be reinforced by bearing blocks securely fastened to the poles.

(d) Ledgers shall be securely nailed or bolted to each pole and where possible shall be nailed or bolted to the inside of the poles or uprights.

(e) Where two ledgers overlap on the same pole they shall be securely fastened and where two ledgers meet at right angles one shall be fastened with its end sawed flush with the pole, the other overlapping in the usual manner.

Section 160. (a) Putlogs shall be square or rectangular in cross section and shall project not less than six (6) inches over the ledgers. There shall be not less than three (3) putlogs under platform planks and so spaced as safely to carry the load imposed upon them.

(b) The ends of putlogs on single pole types shall be built into the wall and shall not be notched or cut down.

(c) Putlogs shall project into the wall not less than four (4) inches and, where window or other openings are used, shall be rigidly held in place by effective supports and bracing.

(d) Two successive lengths of planking shall not abut upon a single putlog. When laid end to end, two parallel putlogs shall be provided not more than eight (8) inches apart so one putlog will support the end of one plank and the other putlog the abutting end of the other plank.

(e) Where the platform planks overlap on a single putlog the lap of both the lower and upper plank shall be not less than six (6) inches over the center of the putlog. Platform planks shall project over the putlog at the end of the

scaffold not less than six (6) inches beyond the face, but not more than twelve (12) inches, unless securely fastened against slipping or tipping or railed off in accordance with section 145¹ of this code.

Section 161. (a) Bearers shall be attached to frame buildings by notching a piece of lumber not less than two by four (2×4) inches by twelve (12) inches long to the size of the bearer so it will bear evenly on the two (2) inch surface. The plate or piece so prepared shall be nailed securely to the side of the building and the bearer nailed to the plate.

(b) Where a scaffold turns a corner, not less than one bearer shall be laid and securely fastened diagonally across the corner, so that one end may rest upon each of the two ledgers that meet at the corner, or by a two (2) by six (6) inch timber nailed to the outside of the end poles to act as bearer. Poles shall be spaced at shorter intervals and platform planks laid so as to prevent the tipping hazard or secured or guarded as provided in section 145.¹

Section 162. Pole scaffolds shall be securely and adequately braced and fastened in such manner as to prevent swinging away from the building. Diagonal bracing shall be provided to prevent the poles, whether spliced or not, from moving parallel to the walls or from buckling in any direction.

Section 163. The following schedules of designs and dimensions shall be used for all pole scaffolds. Materials of different sectional dimensions may be used, but they shall be of equal or greater strength than that given in these schedules. Spacing may be increased if the material and the cross-bracing to be used are increased sufficiently to give strength and rigidity equal to that required by the schedules.

POLE SCAFFOLDS NOT MORE THAN 25 FEET IN HEIGHT

	Stone-masons 75 lbs	Brick-layers 50 lbs.	Lathers, plasterers (stucco) 30 lbs.	Carpenters (misc.) 20 lbs.	Painters and decorators 20 lbs.
Poles	4×4 in.	2×6 in.	2×6 in.	2×4 in.	2×4 in.
Ledgers when used.	2×8 "	2×8 "	1×6 "	—	—
Stringers	1×6 "	1×6 "	1×6 "	1×4 "	1×4 "
Bearers	2×6 "	2×6 "	2×6 "	1×8 "	2×6 "
Putlogs	4×4 "	4×4 "	—	—	—
Putlogs on edge nailed	2×6 "	2×6 "	2×6 "	—	—
Braces	1×6 "	1×6 "	1×6 "	1×4 "	1×4 "
Spacing poles (longi- tudinal)	7 ft.0 "	8 ft.0 "	8 ft.0 "	8 ft.0 "	8 ft.0 "
Spacing poles (trans- verse)	5 "0 "	5 "0 "	5 "0 "	5 "0 "	7 "0 "
Spacing ledgers (ver- tical)	4 "6 "	4 "6 "	6 "3 "	7 "0 "	7 "0 "
Spacing putlogs or bearers	Approx. middle of span				
Planking	2×10 in.	2×10 in.	1¼×12 in. net	2×10 in.	2×10 in.
Toeboards	2×6 "	2×6 "	—	1×6 "	—
Toeboards if nailed in center	1×8 "	1×8 "	—	—	—

Notes: (1) Scaffolds over 25 feet and up to 64 feet in height:

Stone-masons' poles	4×6 in.
Bricklayers' poles	4×4 "
Plasterers' poles	4×4 "
Carpenters' and miscellaneous poles	2×6 "
Painters' poles	2×6 "

¹ See under § 4 (b) "Gangways, runs, etc."

(2) Members which do not carry putlog or bearer load are designated as stringers.

(3) Pole scaffolds over 64 ft. in height shall be so built that the working stresses in the members shall not exceed the allowable unit stresses as given in section 23¹ of this code.

(4) The minimum width of carpenters', painters', decorators' and miscellaneous platforms shall be two, 2 × 10 in. planks.

(5) Guardrails, toeboards, side screens and overhead protection shall be provided on the outside of all pole scaffolds as required in sections 239 to 245² inclusive and sections 254 and 255³ of this code.

(6) Pole scaffolds for work heavier than stone-masons' pole scaffolds shall have a factor of safety of not less than four (4) and shall conform to the general requirements for masons' pole scaffolds.

(7) If the spacing of the poles as shown in the above schedules is increased, the sizes of members shall be increased to conform with the allowable loads and stresses as provided in the tables, sections 23¹ and 157² of this code.

(8) If ledgers or bearers are removed, adequate cross-bracing shall be provided to maintain the strength and rigidity required by the schedules."

(S.R., March 1931.)

Pennsylvania

"Rule 2. *Single pole scaffolds.* (a) Single pole scaffolds shall be classified as of two types:

(1) Light duty

(2) Heavy duty

"Light duty" scaffolds shall be those used by carpenters or others and which carry no load other than the workmen and a minimum of lumber or other light weight material. "Heavy duty" scaffolds shall be those used by bricklayers, masons, stucco workers, etc., and which, in addition to the workmen, carry a supply of bricks, stone or other heavy building material.

(b) Sizes of poles or uprights shall be:

(1) Light duty scaffolds—For two (2) storeys and less, or less than thirty (30) feet at least two by four (2 × 4) inches in cross section. For more than two (2) storeys and less than five (5) storeys or more than thirty (30) feet and less than fifty (50) feet, at least two by six (2 × 6) inches or three by four (3 × 4) inches in cross section. For five (5) storeys or more, or more than fifty (50) feet, at least four by four (4 × 4) inches in the cross section or heavier.

(2) Heavy duty scaffolds—Two (2) storeys or less, or less than thirty (30) feet, at least two by six (2 × 6) inches or three by four (3 × 4) inches in cross section. More than two (2) storeys or more than thirty (30) feet, at least four by four (4 × 4) inches in cross section or heavier. For extra heavy work, or more than five (5) storeys, sizes of poles shall be correspondingly increased.

(c) Distance between poles shall be:

(1) Light duty—Seven (7) feet regardless of height, except where demands upon the scaffold justify it, a spacing of less than seven (7) feet between poles shall be provided.

(2) Heavy duty—seven (7) feet regardless of height, except where demands upon the scaffold justify it, a spacing of less than seven (7) feet between poles shall be provided.

(d) Poles and uprights shall be spaced uniformly from the wall, and parallel to it. Spacing shall be as follows:

(1) Light duty scaffolds—Two (2) storeys or less, and not to exceed thirty

¹ Not reproduced.

² See under § 1 (c) "Scaffold Materials and Construction".

³ See under § 6 (c) "Catch Scaffolds and Protective Roofs".

(30) feet, not more than five (5) feet from wall. More than two (2) storeys, or more than thirty (30) feet, not more than six (6) feet six (6) inches from the wall.

(2) Heavy duty—Four (4) storeys or less and not to exceed fifty (50) feet, not more than six (6) feet six (6) inches from the wall. Scaffolds over four (4) storeys or more than fifty (50) feet may be set farther from wall; providing uprights and putlogs are made heavier.

Where pole scaffolds are used for work of a very light nature, the width of the platform may be reduced to a size consistent with the work being done and the safety of the men working thereon.

(e) The lower end of poles or uprights shall not rest upon the surface of the ground, but shall be firmly embedded to a depth of at least eight (8) inches. Where the soil is of a soft nature a sound block or piece of plank at least one (1) foot square by two (2) inches thick shall be placed in the hole and the upright placed squarely on the centre of such support and securely nailed thereto or otherwise fastened, the hole then being filled and solidly tamped. Where a pole bears directly on a sidewalk or other solid substance, it shall be rigidly secured at the bottom by other effective means.

(f) When necessary to increase the height of a pole by splicing, the upper pole shall be set squarely upon the end of the lower one, the abutting ends being square and flat. At least two cleats shall be used to each splice or joint and they shall be of sound wood at least four (4) feet long and one (1) inch thick and in width not less than the width of the pole. They shall be securely nailed to both poles and shall be placed so as to overlap the abutting ends of each pole at least two (2) feet. They shall be fastened to the poles at right angles and not on opposite sides. Two or more consecutive or contiguous uprights shall not be spliced at the same general level.

(g) Ledgers shall be not less than one (1) inch in thickness and ten (10) inches in width for light duty scaffolds and at least twelve (12) inches in width for heavy duty scaffolds. They shall be long enough to extend over two consecutive pole spaces and shall overlap the poles at each end by at least four (4) inches. As the platform is raised with the progress of the work the ledgers upon which it has previously rested shall not be removed but left in position to brace and stiffen the poles. Ledgers shall be level and their top edges at the same height as the bottom of the openings in the wall into which the putlogs are inserted. Ledgers weakened by nail holes or split at ends shall not be used. In putting up new ledgers, cleats of a size at least one (1) inch in thickness, ten (10) inches long and at least the width of the pole, shall be fastened to the poles and upon which the ledgers shall rest.

(h) Unless clamps or thru-bolts are used, ledgers shall be nailed to each pole by at least four (4) tenpenny nails. Ledgers shall be fastened to the inside of the poles or uprights. Where two ledgers lap over each other on the same pole, they shall be fastened equally secure, and where two ledgers meet at right angles, one shall be fastened with its end sawed squarely flush with the pole, while the other one overlaps in the usual manner. Nails shall not be driven close to the top edge of a ledger.

(i) Putlogs shall be square or rectangular in cross section, not less than three inches by four (3×4) inches or two by six (2×6) inches set on edge and shall be long enough to project over the ledgers at least six (6) inches. Putlogs shall be set squarely in position and the ends shall be built into the wall but shall not be notched or cut down except on alteration or repair work when they may be so treated to fit into a space obtained through the removal of a brick. In such cases the notch shall be on the upper side of the putlog, and shall be just deep enough to permit the end of the putlog to be inserted in the hole in the wall and shall not be more than four and one-half inches (4½) in length. Putlogs shall project into the wall at least four (4) inches and where window openings are utilized instead of the wall proper, the putlogs shall be rigidly secured by effective supports and bracing. There shall be at least three putlogs under every platform plank, one at each end and one in the center, spaced uniformly and bearing upon the ledgers as close to the poles as possible.

When attaching putlogs to a frame building, the procedure shall be as follows: Notch two pieces of one by eight (1×8) inch lumber eighteen (18) inches long with notches the size of the putlogs so that the putlog bears on the narrow surface. These notched pieces shall then be nailed one upon the other to the side of the building and the putlog nailed to the notched pieces.

(j) Platform planks shall not be less than two (2) inches thick by ten (10) inches wide and shall be uniform in length. They shall be laid so that the sides abut and fit "tight". Two successive lengths of planking shall not abut upon a single putlog. If planks are laid end to end, two parallel putlogs shall be provided not more than eight (8) inches apart, and in such a manner that one putlog supports the end of one of the planks and the other putlog supports the abutting end of the other plank. Where platform planks overlap on a single putlog, the lap of both the upper and lower planks shall be at least six (6) inches over the center of the putlog. Platform planks shall project over the last putlog at the end of the scaffold by at least six (6) inches but in no case more than twelve (12) inches.

(k) Where a scaffold is built around a corner, at least one putlog shall be laid and securely fastened diagonally across the corner so that one end may rest upon each of the two ledgers that meet at the corner. Care shall be taken in laying platform planks, so that no tipping hazard exists. Poles shall be spaced at shorter intervals.

(l) Pole scaffolds shall be firmly and adequately braced or shored in such a manner as to prevent them from swinging away from the building. Where spring stay braces are used they shall be placed at least in every alternate horizontal row of putlog holes. Diagonal bracing shall also be provided to prevent the poles from moving parallel to the walls of the building, or from buckling, whether spliced or not.

(m) Where the use of horses is necessary they shall conform to the requirements set forth in Rule 14.¹

(n) Protection shall be afforded as set forth in Rule 23 on 'Protection'.²

Rule 3. Independent pole scaffolds. (a) The poles, ledgers, platforms and fastenings of independent pole scaffolds shall be built in conformity with the specifications set forth in Single pole scaffolds. Rule 2.

(b) The inner row of poles shall be set as near the wall of the building as practicable and the outer row of poles shall be not less than six (6) feet six (6) inches from the inner row for light duty scaffolds up to two (2) storeys or thirty (30) feet in height and not less than seven (7) feet six (6) inches for light duty scaffolds over three storeys or over thirty (30) feet in height and for all heavy duty scaffolds. Each set of poles, outside and inside, shall be provided with its own ledgers. The distance between poles (parallel to wall) shall be the same as for Single pole scaffolds, Rule 2.

(c) Putlogs shall be laid on ledgers sidewise, one at each pair of poles (inside and outside) and shall be securely nailed to the poles. They shall be at least two (2) inches in thickness and long enough to rest upon both inner and outer ledgers, overlapping each ledger by at least three (3) inches.

(d) Particular care shall be taken that the bearing or footing of independent pole scaffolds is solid and firmly secure.

(e) Adequate diagonal bracing shall be provided and such cross braces shall be nailed to every pole crossed. Cross bracing between front and rear poles shall be provided and the free ends of scaffolds shall be double cross braced.

(f) Where the use of horses is necessary they shall conform to the requirements set forth in Rule 14.¹

(g) Protection shall be afforded as required in Rule 23.²

(R. 1933.)

¹ See under § 2 (g) "Trestles and Trestle Scaffolds, etc.".

² See under § 6 (c) "Catch Scaffolds and Protective Roofs" and § 8 (c) "Protection of the Public".

Wisconsin

"Order 3514. *Built-up scaffold framework.* Posts for post scaffolds shall be spaced not more than 8 ft. center to center, measured along the platform, and shall conform to the requirements of Order 3513.³

Unsupported height means distance between points where braces, ties or ledgers are attached, or other lateral support is provided.

Where necessary to increase the height of a wood post by splicing, the squared end of the upper section shall rest evenly upon the squared end of the lower section, and the two ends shall be held in place by fastening not less than two wood cleats, each not less than 3 ft. in length, to adjoining sides of such post. The combined sectional area of the cleats shall be not less than that of the post (based on nominal dimension). Every post having joints shall be braced at a point not more than 3 ft. from the joint.

In the construction of single post scaffolds, the scaffold framework shall be braced to the adjoining permanent structure, in the case of independent post scaffolds, the scaffold framework shall be braced independent of the adjoining permanent structure.

Ledgers shall be not less than nominal 2×8 in. in sectional dimension, except that where putlogs are supported only at posts the section of the ledger may be reduced to not less than nominal 2×6 in. in sectional dimension, and except further in the case of scaffolds for carpenter and similar light work where every putlog is fastened to a post at the point where it rests on the ledger, the thickness of such ledgers may be reduced to not less than nominal 1 inch. Ledgers shall not be loosened or removed until the scaffold is dismantled.

Ledgers shall be fastened to the inside (platform side) of posts wherever possible. In the case of scaffolds used by masons and upon which wheeling is done, where such fastening is by nailing to the post, the nail support shall be reinforced by providing a cleat (of same thickness as the ledger) fastened to the post directly under the ledger. Where it is necessary to fasten a ledger to the outside of a post, such fastening shall be by bolting.

Putlogs for the support of working platforms shall be square or rectangular in cross section, and shall be fastened to, or arranged by means of cleats, clamps or other devices so that they cannot slip from, the supporting members. Putlogs shall project over ledgers not less than 6 inches, nor more than 10 in, unless a temporary guard railing (Order 3504)³ is provided at the edge of the platform, in which case the putlogs may project not more than 30 in. Putlogs shall extend over wall bearings not less than the depth of the putlog, but in no case less than 4 in., and shall not be notched or otherwise reduced in section to fit bearing holes in walls. Where, instead of putlogs, cross-beams fastened to posts (or to a part of the building construction) are used to support scaffold platforms, such beams shall be not less than nominal 2×6 in. in cross sectional dimension. No putlog or similar cross beam having a cross sectional dimension less than 4 in. (nominal) shall be used to support a platform on which wheeling is to be done, unless two putlogs, one nailed to each of two opposite sides of each post, are provided."

(G.O. 15.7.1933.)

FINLAND

"19. Scaffolding for house building may be either single or double.

In single scaffolding the weight of the scaffolding shall be borne partly by the walls of the building and partly by a row of standards placed at a certain distance from the walls and parallel to them.

In double scaffolding the weight shall be borne by a second row of standards instead of the wall.

Further, in the building of wooden houses a single scaffolding may be used in which the standards are supported by diagonal braces to prevent lateral displacement.

¹ See under § 2 (g) "Trestles and Trestle Scaffolds, etc."

² See under § 6 (c) "Catch Scaffolds and Protective Roofs" and § 8 (c) "Protection of the Public"

³ See under § 1 (c) "Scaffold Materials and Construction"

In single scaffolding the standards shall not be placed less than 1.4 m. or 1.7 m. from the wall (the first-mentioned distance applying to the building of wooden houses). In double scaffolding the rows of standards shall be at least 2 m. apart.

The distance between the standards measured parallel to the side of the building shall not be more than 2.5 m. under either system.

For bricklaying, plastering, stoneworking and other similar work the scaffold stage shall not be less than 1.5 m. wide. The scaffold stage for building wooden houses shall not be less than 1.25 m. wide.

For pointing and rubbing down, the scaffold stage shall not be less than 0.8 m. wide. For painting and other similar work the scaffold stage shall not be less than 0.6 m. wide.

Single scaffolding shall consist of the following principal parts, viz., the standards, the horizontal poles or ledgers connecting them, the putlogs supported by the walls and ledgers and serving as a support for the scaffold stages, the flooring bearing the load on the scaffolding, the diagonal and cross bracing reinforcing the scaffolding lengthwise and crosswise, and the wall anchor irons. In addition, cleats shall be used in this system of scaffolding to support the ledgers.

Double scaffolding shall comprise the above-mentioned principal parts, and also a second row of standards with ledgers connecting them.

20. The dimensions of the standards used for the construction of scaffolding shall be such that they can bear the weight of the scaffolding itself and all loads borne by it.

Both in single and in double scaffolding the dimensions of the standards shall depend upon the distance between the standards and upon the height and loading of the scaffolding. Nevertheless, they shall not fall below the limits hereinafter prescribed.

If the highest scaffold stage is about 5 m. from the ground, the squared thick ends of the standards shall be at least 10 cm. square. If the stage is more than 5 m. from the ground, the butts shall be at least 12.5 cm. square.

Both in single and in double scaffolding the thickness of the ledgers shall be fixed according to the distance between the standards measured parallel to the length of the building, and to the load to be borne by the stages.

If the distance between the standards measured parallel to the length of the building is not more than 2.5 m., the ledgers shall measure 5 cm. by 15 to 20 cm., according to the distance between the standards. If the standards are more than 2.5 m. apart, the ledgers shall be proportionately stronger. If the distance between the standards is so great that it is difficult to provide sufficiently strong ledgers the middle of each ledger shall be supported by a diagonal or a suspended brace.

The cleats used as supports for ledgers shall not measure less than 5 by 12.5 by 35 cm.

The cleat at the point where two ledgers are joined shall be sufficiently thick to support both ledgers. In scaffolding used for building wooden houses, where ledgers properly so called are not used, they shall be replaced by a horizontal bar measuring 2.5 by 12.5 cm. in cross section.

The dimensions of the putlogs shall be fixed according to the distance between the putlogs, the load which the scaffolding bears, and also in single scaffolding the distance between the ledger and the wall, and in double scaffolding the distance between opposite ledgers.

The distance between adjacent putlogs in the middle of the scaffolding shall not exceed 1.5 m.

Squared putlogs shall not be less than 12.5 cm. square. Such putlogs may be used both in single and in double scaffolding when the distance between the bearings of the putlogs is not more than 2.4 m. If the breadth of the scaffolding is greater, proportionately stronger putlogs shall be used.

If particularly heavy loads are to be handled on the scaffolding, double putlogs shall be used, or a putlog shall be fixed on each side of every standard.

Pairs of planks measuring at least 5 cm. by 10 cm. or other equally strong timber shall be used as putlogs in single scaffolding for the building of wooden houses.

The flooring planks used in scaffolding shall not be less than 4.6 cm. thick, or in scaffolding for wooden houses 3.2 cm. thick. Scaffolding planks the thickness of which is fixed to carry a certain load shall not be replaced by double boards of half the thickness.

The minimum dimensions of diagonal and cross braces shall be as follows:

for braces to bear pressure, 5 cm. by 12.5 cm.;
for braces to bear tension, 2.5 cm. by 10 cm.

21. In the erection of standards, care shall be taken that the footing of each standard is capable of bearing the pressure put upon the standard. If the load is too heavy for the footing of the standard, either the footing shall be reinforced or the load shall be suitably distributed over a larger area.

If the standards are erected on the ground, the butts shall be embedded therein or other precautions shall be taken against their slipping.

The outer row of standards shall if possible lean a little towards the wall.

If the standards are liable to be uprooted by the pressure of the wind or by any other cause, they shall be anchored to their base.

The standards of scaffolding shall whenever possible be poles without joints. When it is necessary to lengthen standards, the joints shall be arranged in conspicuous places and carefully made.

If standards are butt-jointed, the surfaces meeting at the joint shall be made to fit together. The joint shall be enclosed in a wooden or iron casing attached to the standards with nails, bolts, iron hoops, etc.

If standards are lap-jointed, the joint shall be held together by means of bolts traversing it or by iron hoops, and the upper standard shall be supported by a strong block in order to prevent vertical displacement and the breaking of the joint. The jointed ends shall overlap for not less than 1 m.

The ledgers shall be attached directly to the standards, on the inner side of the outer standard, and in double scaffolding on the outer side of the standard next the wall.

Joints in ledgers shall be made close to a standard. For this purpose one of the planks forming the joint shall be nailed fast to the standard, and the outer plank shall then be secured to the plank already fixed, by means of nails so long that some are driven at least 5 cm. into the standard and the ends of others are driven through the inner plank and can be properly clinched against it.

If the ledger is fastened to the standard, a securely nailed block or cleat shall be fixed as a support for the plank before the scaffold stage is loaded.

In placing putlogs, care shall be taken that in single scaffolding the end of the putlog shall have a bearing of not less than 15 cm. in the wall. Putlogs shall not be supported on piles of bricks or other similar materials.

In the building of wooden houses, the ends of the putlogs shall be fastened to the wall pillars and shall be supported by cleats below and on the outer side.

The outer ends of the putlogs shall be fastened either directly to the standards or to ledgers. The former method shall be adopted for wooden buildings. In the latter case a putlog shall also be fastened to every other standard. The putlogs shall be fastened so that they cannot slip.

In the building of wooden houses, if ledgers and the cleats supporting them are used in the scaffolding, the putlogs shall be securely nailed to the standards and supported by means of cleats.

In the construction of staging, the scaffolding planks shall be laid and fastened so that they are not liable to be loosened by loading, and at least the outside plank of the staging shall be nailed in position. The planks shall be laid so that their ends extend well beyond the putlogs. Damaged and worn-out planks shall be replaced by new ones.

When parts of the scaffolding are split by the use of nails, screws or bolts, they shall be replaced by new parts. In bolted joints, the screws and nuts shall be properly tightened and shall be screwed up subsequently as required.

Iron hoops used in the construction of scaffolding shall be prevented from slipping by means of nails, wedges or otherwise.

In case of slipping or displacement in any part of the scaffolding where there is a joint, further slipping or displacement shall be prevented by means of repairs or the renewal of the joint.

22. Struts and stiffening planks used to support and reinforce scaffolding shall be accurately adapted to the structure, so as to prevent the collapse or twisting of parts of the scaffolding.

If it is necessary to use diagonal and cross braces in the erection of scaffolding, and these hinder work at right angles to the scaffolding, the use of such braces may be replaced by the bracing or guying of the standards to the wall. If necessary, some of the braces may be made to run directly from the ground across the scaffolding to its highest point. The provisions of section 31¹ shall be observed in respect of the bracing of scaffolding with unloading platforms and hoists.

Builders' scaffolding shall be guyed to the walls of the building, or strutted, in cases where the scaffolding is not intended to hang freely.

The scaffolding shall be stayed to the walls by means of double iron tie rods which can be tightened and which are fixed through the wall of the building or attached to some other stable part of the building. The outer ends of the tie rods shall be fixed into the stable angle between the standard and the putlog under the staging.

If planks are used to stay the scaffolding, one end shall be fastened to the standard and the other to a floor joist or some other stable part of the building.

The heads and nuts of bolts used in wooden joints of scaffolding shall have anchor plates.

Guys may be fastened to stone or rock with a bolt and key or in any other efficient manner.

Steel wire ropes used for stays shall be fastened by means of a stay bolt with a cable key."

(Res. 15.11.1927.)

FRANCE

" 28. Fixed scaffolds shall be so constructed, stayed and braced that they can bear the loads placed on them and resist the pressure of the wind.

29. The scaffold poles or uprights shall be let into the ground or fixed in such a way as to prevent any displacement of their lower ends.

If uprights are spliced the join must be strengthened in such a way that the strength of the piece joined on is at least equal to that of the piece immediately below.

When ropes are used for attaching the horizontal to the vertical parts, they shall be of sufficient length to pass at least five times round the horizontal and the vertical parts.

The putlogs, which shall be of oak in perfect condition, shall be carefully secured at the ends. The distance between them shall be suited to the loads for which they are intended and the nature of the platform. When the platform is of deal planks 35 to 40 mm. thick (mason's planks), the distance between the putlogs shall not exceed 1.33 m.

30. When the scaffolding comprises only one row of standards, one end of the putlogs shall be fixed in the wall. The sealings shall be solidly made and shall be at least 10 cm. deep. In default of sealing, the whole shall be securely anchored to the main structure.

31. The planks or boards forming the platform of a scaffold shall fit closely against one another and shall rest on not less than three putlogs, so that they cannot rock.

If there is a dangerous overhang, or if there are only two putlogs, rocking shall be prevented by a fastening.

32. The guard-rails prescribed in section 66a of Book II of the Labour Code shall consist of a cross piece of at least 40 cm. cross section securely fixed on the inside of the uprights.

¹ See under "Hoisting Appliances: § 1 (c) Materials and Construction: Hoists" and "Hoisting Appliances: § 2 (d) Supporting Structures: Landings".

In addition, a toe-board at least 15 cm. high shall be placed along the outer side of the scaffolding.

33. When fixed scaffolds are erected on roofs, their uprights shall rest on firm parts of the structure."

(D. 9.8.1925, 26.11.1934.)

GREAT BRITAIN

"3. Pole standards and the legs of gabbard scaffolds shall be vertical and fixed sufficiently close together to secure the stability of the scaffolding having regard to all the circumstances of the case; the ledgers shall be practically level, and the whole scaffold shall be sufficiently and properly braced. Gabbard scaffolds, frames, standards, or other appliances used as supports for working platforms shall be of sound construction, shall have a firm footing and shall be adequately secured, strutted and braced. The legs and needles of gabbard scaffolds shall be securely fastened together by bolts, dogs, clamps, or other effective means.

18. Every pole used for scaffolding shall have the bark stripped off."

(R. 21.6.1926.)

IRISH FREE STATE

As for Great Britain.

LUXEMBURG

"7. In the case of ordinary builder's scaffolding the standards shall be erected at intervals of not more than 2.50 m. and shall be sunk not less than 1 m. into the earth; if they are not planted in the earth, they shall be suitably secured, e.g. by being set in plaster or by clamping to sole-pieces, so that they cannot move or sink into the ground.

The standards shall in addition be secured against lateral deflection and displacement outward by diagonal braces, and shall be secured to the inside of the building or else sloped towards the building.

The standards and ledgers shall be not less than 10 cm. in diameter at the tip. The individual timbers shall be lashed together with strong hemp or wire ropes or chains. Single iron wire shall not be used for this purpose. In addition the junctions shall be strengthened by iron clamps or cleats, which shall be fixed to the standards by nails or iron bands.

The lengthening of a standard by placing a second standard upon it shall be effected by overlapping the ends for a length of not less than 2 m., and lashing the two standards together with hemp or wire rope in at least three places. The upper standard shall rest upon a ledger and shall be underpinned with strong iron clamps, or shall be stayed on a firm base from ledger to ledger down to the ground.

The putlogs connecting the ledgers with the building, on which the scaffold boards rest, shall be placed at intervals of not more than 1.20 m.; they shall be fastened at both ends and shall be lashed to the ledgers at intervals of 3.60 m. They shall have not less than 20 cm. bearing on the ledger and shall be not less than 10 cm. in diameter at the tip.

8. The scaffold stages shall be placed at intervals of not more than 2 m. and shall be not less than 1 m. wide, so that the workers may pass each other easily.

The floor-boards shall be squared and not less than 3 cm. thick, and shall be so placed on the putlogs and fixed that they cannot tilt or be displaced or leave gaps through which materials may fall.

The scaffold stages shall be provided with strong balustrades or guard-rails about 1 m. high throughout their length and at both ends, and at the base thereof shall be placed a fender board not less than 20 cm. high.

The use of hemp or wire ropes for guard-rails shall be prohibited.

For the safety of the workers a closely laid stage shall be left or erected under every scaffold stage on which work is being carried on; the distance between the two stages shall be not more than the usual distance of 2 m."

(O. 28.8.1924.)

NETHERLANDS

Round Timber Mason's Scaffolding and Fittings

1. All the component parts of the scaffolding shall be correctly constructed of sound materials, the dimensions being appropriate to the purpose for which it is required. The round timber to be used shall be stripped before use.

2. When round timber is used and there are no special rules to the contrary (cf. section 8), the average circumference of the part lying between the top and 1 m. from the bottom end of all *standards*, *extension poles* and *ledgers* shall be not less than 34 cm., the circumference at the top end shall be not less than 25 cm.

3. The circumference of *putlogs (needles)* shall be not less than 30 cm. when round timber is used, unless the platform is not to exceed 1.30 m. in width and no materials are to be transported on it by means of barrows, in which case a circumference of 25 cm. shall suffice. The putlogs shall be straight.

4. *Scaffold planks* and *toe-boards* shall be not less than 3 cm. thick and 20 cm. wide; the ends shall be protected against the risk of splitting or cracking.

5. *Guard-rails*, if round timber is used, shall be not less than 25 cm. in circumference at the thinner end. If squared timber is used, its section shall be not less than 5 by 7 or 3 by 20 cm.

6. The wood used for *bracing* shall be either squared timber of not less than 5 by 7 or 3 by 20 cm., or round timber of not less than 25 cm. in circumference at the thinner end.

7. *Diagonal bracing* (anchoring timbers) shall be of squared timber with a section of not less than 5 by 7 or 3 by 20 cm.

Round timber with a minimum diameter of 25 cm. at the thinner end may be used for standards when there are no openings in the walls.

8. *Standards with more than one extension* shall have a circumference of not less than 58 cm. 1 m. from the foot and not less than 34 cm. at the top, unless a double standard of the dimensions specified in section 2 is used, the two standards stand close together in the direction of the scaffolding and the difference in their length is not less than 2½ m.

9. *Lashings* for assembling parts of scaffolding shall be strong and of sufficient length; they shall not be less than 1 cm. in diameter and the ends shall be protected against fraying.

10. Standards shall be secured against sinking and lateral displacement. The outer row of standards shall lean slightly towards the wall of the building. In the case of scaffolding on or along roads used by traffic, posts shall be placed, if necessary, to prevent collision with the standards.

11. The distance between the wall and the inner edge of the standards at the level of the highest platform shall be not less than 1.25 and not more than 1.65 m. unless, for some special reason, a wider or narrower scaffold is necessary.

12. The distance between the standards shall not exceed 2 metres, except at gateways, etc., where a wider space may be necessary, provided that adequate precautions are taken against a possible weakening of the scaffold at these points, and except in the case of scaffolds with a platform not more

than 5 m. above the ground, when the distance between the standards shall not exceed 2.5 m.

At corners of buildings where two scaffolds meet, a corner pole shall be set up.

13. Cleats for supporting parts of scaffolds should not be nailed on; it is better to secure them in the most suitable way to the standards by means of steel wire of adequate length.

14. Extensions (with the exception of the top row) shall be not less than 8 m. long if round timber is used. At the points where extensions are joined to standards or to each other, they shall overlap for a distance of not less than $2\frac{1}{2}$ m. and shall be carefully bound together at at least two points not less than 1.5 m. apart with lashings or some other adequate kind of tie.

If heavy standards are extended (as mentioned in section 8), the extension shall be joined to the standard over a length of not less than 3 m., the two being lashed together at at least three points not less than 1 m. apart.

If the standards are extended more than once, double timbers shall be used; in this case the lower end of the extension shall be placed on top of the standard or existing extension, except in the case mentioned in the previous paragraph. The last (topmost) extension may be single.

Extensions that cannot be placed upon a standard shall be supported by a cleat, unless suitable clamps are used.

When lashings are used to secure extension poles, each pole, counting from the top, shall have at least six turns of the lashing for the first extension and two further turns for each subsequent extension. The lashings shall be well tightened by means of wooden wedges.

15. Ledgers shall be securely fixed to the standards or extension poles and shall in addition, if a platform rests on them, be supported by cleats, struts or steel wire, unless suitable clamps are used.

When struts are used, they shall rest on the ground or on the next lower ledger in the same way as the standards; they shall be adequately attached to the standard of extension at not less than two points by lashings or some other means.

The cleats shall be fitted before there is any load on the platform.

If a ledger is in more than one part, the parts shall overlap by not less than 1 m., and they shall be bound together at at least two places, or else their ends shall be carefully fitted together and attached to an auxiliary ledger overlapping each of them for a distance of not less than 1.50 m. and attached to each at at least two points. The attachments shall be by means of lashings (10 turns at least at each point) or in some other appropriate way, but not by means of nails.

At corners, both ledgers shall be secured to the corner pole.

16. The distance between the various ledgers that can be attached to the standards or extensions shall not exceed 3.5 m.

17. The distance between two putlogs shall not exceed 1 m., except opposite window openings, where the distance between the ends nearer the wall may be not more than 1.5 m. They shall be slightly inclined towards the building, shall penetrate not less than 10 cm. into the wall, shall project not less than 10 cm. beyond the ledgers and shall rest directly on these last.

Putlogs for which there is no resting place in the wall shall be adequately underpinned.

Suspension beams shall not be used unless they lie as close to the wall as possible and are attached by lashings (at least 10 turns in each case) to two putlogs resting in the wall and not more than 2 m. apart.

Putlogs that are free at both ends shall be securely attached to the ledger at one end at least.

18. At least every second standard or extension shall be adequately anchored by bracing to the joisting or, failing that, to some other solid part of the building at the level of every storey—or, in the case of towers and buildings with storeys exceeding 4.5 m. in height, at vertical intervals of not more than 4.5 m. If such bracing in any way impedes or endangers those

working on the scaffolding, it may be removed, but not until similar bracing has been fitted at a higher or a lower level.

19. In the case of scaffolds with platforms at a height of more than 5 metres, diagonal bracing shall be placed over the whole of the scaffold on the outer side of the standards and extensions, making an angle of about 45° with them.

The braces shall be securely attached, not only to the standards and extensions, but also at all points of intersection.

Round timber bracing shall not be attached to other parts of the scaffold by means of lashings.

20. No platform shall be erected more than 2.5 m. above the highest point at which the scaffold is anchored to the building. Every platform shall be sufficiently solid and so placed that materials and tools cannot fall through and the planks cannot tip up or be displaced. At ends and corners of scaffolds and at other points where no weight rests on them they shall be secured against tipping up. At ends and corners of scaffolds the platforms shall not project more than 30 cm. beyond the putlogs or supporting beams.

Platforms resting directly on joisting shall be not less than 1.40 m. wide.

21. Gang-planks shall be sufficiently strong, well built and supported, and their width shall be not less than 60 cm. If they are also used for the transport of materials, they shall be not less than 80 cm. wide.

If the slope of a gang-plank exceeds 15° from the horizontal, it shall be fitted over its whole width with treads to prevent slipping.

22. Every platform or gang-plank at a height of more than 2.5 m. above the ordinary ground level, and all openings in the same shall be fitted with securely attached toe-boards to a height of not less than 40 cm. above the level of the platform and with securely attached guard-rails at a height of 1 m. These boards and rails shall also go round the ends of the scaffolding. In the case of platforms and gang-planks at a height of more than 10 m. above ground level, the height of the toe-boards shall be at least 60 cm. above the platform.

If there are windows or other openings at the level of the platform or gang-plank, and there is a risk of falling more than 2.5 m., these openings shall also be fitted with guard-rails.

Guard-rails shall not be required in the case of platforms or gang-planks resting directly on joists, provided that a safety platform is fitted under the joisting or the gang-planks are not less than 1.20 m. wide.

23. *Safety scaffolding* and 24 *Protective screens*. See under § 6 (c) 'Catch scaffolds and protective roofs'.

27. Wooden planks shall not be attached to iron standards or masts by means of iron or steel wire or chains."

(R. 1934.)

POLAND

Pole Scaffolds

"10. (1) The standards shall be installed so as not to be vertically displaced under the effect of the load.

(2) When the standards are let into the ground they shall be sunk to a depth of at least 0.80 m.

(3) If there is a passage-way between the standards, these shall be suitably protected against any impact from vehicles.

(4) The space between the standards and the wall shall not exceed 2.50 m.

(5) Any extension of the standards affected by joining two poles shall comply with the specifications of the Polish Standards Committee.

11. (1) The thickness and spacing of the standards shall be suited to the nature of the work and the anticipated loads.

(2) When the height of a pole scaffold exceeds 22 m., or very heavy loads are anticipated, the competent building authority may require the installation of the scaffold to be justified by static calculations in which due allowance is made for wind pressure, which shall be taken at 120 kg./m² bearing on the scaffold in both directions. Further, the competent building authority may, if necessary, require all the assemblages to be properly carpentered and held together by screw bolts at least 15 mm. in diameter. If round timber is used, the diameter of the screws shall be at least 22 mm. If the scaffold is liable to be heavily jolted, the screws shall be frequently inspected and carefully tightened up.

(3) The cross-section of the standards shall not be less than 0.12×0.12 m. in the case of squared timber; their diameter shall not be less than 0.15 m. at the thin end if round timber is used.

12. (1) The ledgers shall be fastened to the standards. Ledgers shall only be joined at standards.

(2) If the ledgers are not fastened by proper carpentry but only provisionally and with the help of nails, dogs, etc., a cross piece of the same cross-section and fixed in the same manner as the ledgers shall be placed under to support them on the standards.

(3) Horizontal bracing shall not be used as ledgers.

13. (1) The cross-section and the arrangement of the putlogs shall be suited to the loads on the platforms.

(2) The putlogs shall be securely placed on the ledgers or on supports and so fastened that they cannot work loose, come away or tip up.

(3) When the putlogs are let into the wall, the depth of the supporting surface shall not be less than half the length of a brick.

(4) It shall be prohibited to support putlogs on projecting non-carrying parts of the building.

14. (1) Every scaffold platform shall be covered with planks as far as the inside standards, if not as far as the wall. The space between the last plank and the wall shall not exceed 0.05 m.

(2) The planks of the platforms shall rest on at least three putlogs.

(3) The planks on the platforms shall only be joined over putlogs. When the join is made by overlapping, the length of the overlap shall not be less than 0.20 m.

(4) The thickness of the platform planks shall be proportionate to the loads to be borne, and in any case not less than 32 mm.

(5) The planks of platforms shall fit close together so as to prevent the fall of objects on to the platform below.

(6) Every platform more than 2 m. above the ground shall be provided with a toe-board and a handrail 1 m. above the platform, reckoning from the level of the platform to the upper edge of the rail.

15. (1) Pole scaffolds shall be reinforced by means of diagonal bracing, at least at the ends.

(2) The bracing shall be fastened directly to the standards.

(3) Braces may consist of planks, one side of which is unbarked. The braces shall be fastened by means of at least two nails at each end. The length of the nails shall be at least two and a half times the thickness of the plank at the place where it is fastened.

16. (1) In the construction of new buildings by means of outside scaffolds, pole scaffolds shall be maintained until the construction and finishing of the roof are completed.

(2) The highest platform shall be not more than 1.60 m. below the roof cornice, shall be close planked, and in addition to the handrail mentioned in sub-section 6 of section 14 shall be provided with a barrier extending at least 0.60 m. above the roof gutter.

17. (1) The gradient of gangways shall not exceed 1:2.

(2) The floor of gangways shall be provided with stepping laths suitably fastened and not more than 0.40 m. apart.

(3) The gangways shall be so constructed and maintained that the persons using them cannot slip.

(4) Gangways shall be fastened to the cross beams and so reinforced as to prevent them from swinging.

(5) The thickness of the planks shall be proportionate to the loads anticipated; in any case, planks less than 38 mm. thick shall not be used for the floor of gangways."

(D. 23.5.1935.)

SWITZERLAND

Geneva

Heavy Scaffolds

"
42. Outside scaffolds used for the construction of façades of buildings shall be as solid as their purpose requires.

43. Poles or standards used in the erection of scaffolding shall have an average diameter of at least 12 cm. and be placed not more than 3 m. apart. They shall slope slightly towards the façade of the building, and either be sunk at least 60 cm. in the ground or be properly fixed on a wooden foundation so that they cannot be displaced sideways.

The poles shall also be lashed to the building at every second storey and interconnected by bracing in the form of a St. Andrew's cross extending over the whole façade.

Scaffolds shall be stayed and windbraced so as to be able to withstand wind pressure.

44. When a pole is used to extend another, the two shall overlap at least 4 m. The upper pole shall rest on a solid cleat. The two poles shall be lashed together by iron straps or wire ropes, to the exclusion of hemp ropes. Every 2 m. the poles shall be connected to one another by horizontal ledgers supporting the platforms.

With light scaffolds these ledgers may be fixed by means of cramps and hooks.

With heavy scaffolds the assemblages shall be reinforced by wire ropes or chains. The ties supporting the scaffold poles shall themselves be reinforced by dogs or iron brackets. Sheet metal cramps shall not be used. The ledgers shall remain in position until the scaffold is completely dismantled.

45. All putlogs shall be securely fastened to the scaffolding. They shall overhang the ledgers at least 25 cm., be not more than 1.5 m. apart, and be at least 12 cm. thick.

46. An ordinary fixed scaffold shall normally be 1.5-1.8 m. wide, reckoning from the outside of the masonry. In the case of high scaffolds, this width shall be raised to 2.2-2.5 m. A width of 1.5 m. shall only be allowed if the distance between the edge of the roof cornice and the guard-rails is at least 80 cm.

47. Guard-rails and flooring of platforms shall comply with the provisions of sections 23, 27 and 29.¹

48. All openings for working purposes on scaffold platforms shall be provided with regulation guard-rails and toe-boards.

¹ See under § 4 (c) "Working Platforms: General Rules".

Light Scaffolds (for Repair Work on Façades, Balconies, etc.)

49. Light fixed platforms shall be constructed for minor work such as painting, roughcasting, etc., on façades. Ladders shall not be used to support such platforms.

50. To support platforms on light fixed scaffolds, use shall be made only of iron or wooden supports (brackets) of types approved by the Department of Public Works. Brackets formed of nailed planks shall be prohibited.

The poles or standards of these platforms, having an average diameter of 12 cm., shall be placed not more than 3.6 m. apart.

They shall be sunk at least 60 cm. in the ground, or rest on firm foundations so that they cannot be displaced sideways.

They shall be reinforced by stays and be lashed securely to the building. All scaffolding shall be stayed and windbraced so as to be able to withstand wind pressure.

51. It shall be prohibited to support the tops of scaffold poles against the gutters of the buildings.

52. The distance between two superimposed platforms shall not exceed 2 m. They shall be at least 65 cm. wide. The upper platform shall not be more than 1.8 m. below the cornice.

This distance shall be reduced to 1.2 m. when the platform is used by tinsmiths.

The gap between the platforms and the façade shall not exceed 20 cm.

53. Every platform shall be provided with toe-boards and guard-rails complying with the provisions of sections 23, 27 and 29.¹

54. When the platforms are intended for plastering and stone cutters' work, the standards shall be placed not more than 2 m. apart."

(R. 25.3.1930.)

Zurich

" 23. On building scaffolds the standards, the diameter of which at the middle shall be at least 12 cm., shall not be more than 3 m. apart. They shall lean slightly (4 per cent.) towards the frontage to be scaffolded, be sunk at least 90 cm. in the ground, or so mortised, clamped or otherwise fastened to wooden bases that they cannot be displaced at the foot. In this connection care shall be taken with any wiring of the municipal undertakings, which shall be shown in the building plans. The scaffold shall be anchored to the inside of the building at least every two storeys, and the front shall be braced with diagonal poles.

If one scaffold pole is extended by another, the two shall overlap a distance proportionate to their thickness, but at least 6 m., the extension pole shall be firmly supported by scaffold brackets or cleats; in addition the two poles shall be stoutly lashed to each other by means of band iron or wire ropes and dogs.

Every two metres horizontal ledgers shall be placed on the scaffold poles. On light scaffolds the ledgers shall be fastened by lashings and dogs. On more heavily loaded scaffolds the ledgers shall be supported by cleats in addition to lashings, hemp or wire ropes or chains. The cleats shall be fastened with dogs or band iron which shall be wound round at least three times and well nailed and wedged. Flat-iron dogs shall not be used as scaffold clamps. All ledgers shall remain in place until the whole scaffold is dismantled.

All putlogs shall be firmly fastened to the scaffold. They shall lie for at least 25 cm. on the ledgers and at least 15 cm. on the masonry and shall not be more than 1.50 m. or at the most 2 m. apart; they shall be at least 12 cm. thick. Only barked timber shall be used on scaffolds.

The normal width of an ordinary scaffold, measured from the outside foot of the wall, shall be 1.50 m., and of high and hoist scaffolds 2.20 m. The width of 1.50 m. shall only be allowed when the distance between the gable

¹ See under § 4 (c) "Working Platforms: General Rules".

board of the roof cornice and the inside of the guard wall of the scaffold does not exceed 0.8 m.

On small buildings or when tower cranes are used, or on scaffolds on which barrows are not wheeled, a scaffold width of 1 m. shall be allowed.

24. For the construction of the outside walls of buildings two directly superimposed and completely constructed scaffold platforms shall remain in position. On each platform at a height of 90 cm. a stout guard-rail shall be fitted. The guard-rail shall be fixed at the inside of the scaffold poles.

On small buildings of one or two storeys, subject to the authorisation of the scaffolding inspectorate, the second platform may be dispensed with.

25. On frontage walls not more than one brick thick light scaffolds shall be allowed subject to previous authorisation of the scaffolding inspectorate. Such scaffolds shall have closely laid floors extending to the wall, and be so wide that the work to be done on them can be undertaken without risk.

On new buildings, no angle-iron plasterers' scaffolds shall be used.

26. The scaffold boards shall be thick enough for their load, but at least 5 cm. thick and be bound with iron at the ends. They shall be laid closely together; at the ends they shall overlap at least 50 cm.

31. For light masonry and painting jobs, frontage renovation, white-washing, etc., plasterers' scaffolds shall be erected; scaffold ladders shall not be used for this purpose.

32. For plasterers' scaffolds only iron putlogs shall be used. New types of angle-iron putlogs for plasterers' and masons' scaffolds shall be tested together with their couplers or other devices by the scaffolding inspectorate as to their bearing capacity before being used for the first time.

The scaffold poles, of at least 12 cm. diameter at the middle, shall be sunk in the ground or firmly clamped to continuously laid planks at intervals of not more than 3.80 m. The scaffold front shall be cross braced by diagonal poles.

The distance between two scaffold platforms shall not exceed 2 m., and the width of the platforms shall be two planks, but in any case 65 cm. For painters, plasterers and carpenters the topmost platform shall not lie more than 1.80 m. below the top of the roof cornice, and for tinsmiths not more than 1.30 m. Their distance from the frontage shall not exceed 30 cm. On every scaffold platform shall be affixed toe-boards, and at a height of 90 cm. a stout guard-rail of poles, or boards at least 24 mm. thick and 15 cm wide, fastened inside.

For stonecutters' work on frontages, plasterers' scaffolds shall be generally allowed. On such scaffolds the scaffold poles shall be not more than 2 m. apart and the platforms shall be closely laid over the whole width every time, and erected in a manner suited to the height of the work to be done."

(R. 31.1.1931.)

CZECHOSLOVAKIA

"25. (1) The poles and standards shall have a moderate inclination towards the face of the building under construction, and shall be firmly fixed at the base, either by being sunk into the ground to a depth of at least 1 m. and rammed and wedged fast, or, in the case of poles, by being properly fastened to a wooden base so that they cannot either sink into the ground or slip sideways. The earth round the standards and poles, including the surface earth, shall be rammed so that rainwater cannot percolate into the filled-in hole and soften the ground under the standards. Single bricks or bricks piled on one another and the like shall not be used as supports for poles, standards, girders, trestles, ladders and the like.

(2) The thickness of the individual standards and poles and the distances between them shall be fixed according to the estimated load and the dimensions of the horizontal supporting beams laid upon them. The lashings fixing standards to poles, ledgers and other parts shall be sufficiently secure. Rope or wire cable slings shall not be substituted for standards.

26. (1) On high scaffolds the lengthening of standards, at least at the top storey, shall be effected by using buttstraps which shall extend sufficiently far in both directions beyond the junction of the standards or poles and shall be properly secured at both ends. The joint of the lengthened standard or pole shall be arranged to lie at least 1 m. above or below the ledger. Nails shall not be used instead of iron cramps for fastening standards, poles or ledgers.

(2) Ledgers shall always be joined directly above the standards and the joint supported by a short cleat or sufficiently stout post.

(3) Putlogs with one end lodged in the wall shall have firm bearings at least 15-20 cm. wide, and shall be secured against being pulled out of the wall or turning by means of wedging or similar precautions.

(4) Putlogs opposite wall openings shall be laid on trimmers, which shall be properly supported as required, braced and secured against displacement of any kind.

27. (1) Scaffolds shall be duly secured (by anchoring inside the building, or by wind braces) against any displacement. The wind braces shall be fastened to the standards and extend diagonally across the whole scaffold, or at least shall be used in every second or third compartment over the whole height and breadth of the scaffold. Parts of the scaffold on which persons stand or materials are stored shall not be supported by cramps (i.e. without proper struts).

(2) On all scaffold platforms on which work is done or workers must stand, a closely laid and sufficiently strong flooring of sound squared planks at least 2.6-3 cm. thick shall be laid; the flooring shall be at least 2 m. wide (or, if an auxiliary scaffold is to be erected on it, 3-3.5 m. wide) and shall extend to the wall or to the inside poles or standards. Either the ends of the flooring shall not overhang, or they shall have secure fencing over the last struts.

(3) Either the adjacent ends of planks shall lie over two supporting beams placed side by side, or all the planks shall lie on a framework of supporting beams. The substitution of two layers of thinner boards (so-called match-boards) for the flooring shall not be allowed. In the case of scaffolds with several stages, a closely boarded floor shall be laid not only on the stage on which work is in progress but also on the stage next below it.

(4) Communication between the various stages of the scaffold shall be established by stairs, runs or ladders in such a way that the scaffold can be climbed and the workplace reached only by mounting a stage at a time."

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

"80. In order to prevent scaffolding from moving away from the wall of the building, the uprights shall be inclined towards the wall and shall be tied to it by means of putlogs. One end of the putlog shall be fixed to the upright and the other shall penetrate the wall to a depth of not less than 25cm. (1 brick), or else be fixed to the corresponding upright on the other side of the wall. In addition, for greater safety, the uprights shall be fixed to the wall, at intervals of approximately 6 m., by wires fitted with turnbuckles. The uprights shall be attached to or pulled towards the wall itself or to the uprights on the other side of the wall or to some other solid structure.

The uprights shall enter the ground to a depth of not less than 25 cm.; in the case of light or doubtful soil they shall enter to a depth of 1 m. or shall be clamped to the sole-plate. As a rule, when uprights are being erected and their bases being fixed, precautions shall be taken to make certain that they do not sink or become displaced.

When the uprights consist of several poles joined together, the poles shall be securely tied and fixed by means of clamps and new iron bands not less than 1 mm. thick and 26 mm. wide.

When uprights consisting of several poles are extended, the ends shall be

cut with an axe and bound together; the distance between the joins shall not be less than 1.5 m.

94. The uprights and the ledgers shall be assembled by means of clamps. The ends of ledgers and of uprights resting on the ground shall be secured both against sinking into the ground and against slipping—e.g., by means of wooden wedges or sole-plates.”

(O. 5.5.1930.)

URUGUAY

“VIII. The standards of the scaffolds shall in no case be placed more than 4 m. apart, shall be securely anchored in the ground to a depth of from 0.5 to 1 m. and shall rest on horizontal timber plates or on masonry. Further, they shall lean slightly towards the building. Their cross section shall be 0.15×0.15 m. for the first storey and 0.10×0.10 m. for the subsequent storeys. When they have to be constructed from various parts, care shall be taken that each part is as long as possible. The parts shall be joined by means of hoops or spikes.

IX. The putlogs, which shall have a minimum cross section of 0.075×0.15 m., shall not be more than 1.5 m. apart, and shall be firmly fastened to the standards by means of hoops or spikes. The standards shall be tied together by means of St. Andrew's crosses in sufficient number.

X. The boards shall be suited to their purpose and in no case be less than 0.04 m. thick. When it is necessary to join various boards, the joint shall be made exactly edge to edge, and the boards shall overlap not less than 0.50 m. and be secured by nails in sufficient number. The boards shall be secured in the same manner to the putlogs. The width of each platform shall not be less than 0.90 m.

XI. On the outside of each platform, and in contact with it, shall be placed a barrier consisting of a board laid on edge, and inside the standards shall be fixed two rails of strong timber, one 0.70 m., and the other 1.40 m. above the platform.”

(D. 14.4.1915.)

YUGOSLAVIA

Pole Scaffolds

“116. The uprights of pole scaffolds shall be sunk into the ground so as to ensure a solid foundation. When such scaffolds are over-loaded at one side, that side shall be supported by strong wooden braces.

When the wooden uprights are not sunk into the ground they shall rest on a sole-plate of adequate size and shall be joined to each other by strong cross-bars. The sole-plates shall rest on level and sufficiently solid ground.

Working Platforms

At every storey the scaffolding shall have working platforms of strong planks of sufficient length, joined together by bevelled pieces; the ends shall not be loose. The platforms shall be fitted lengthwise with toe-boards rising not less than 20 cm. above the cross-beams on which they rest. The platforms shall also have a guard-rail 1 m. high. There shall be no holes in the platforms through which a workman, materials or a tool could fall.

Access to Upper Storeys

Access to the various storeys of scaffolding shall be by sloping gangways or by steps or ladders, but in every case these shall lead only from one storey to the next.

(R.25.10.1921.)

(b) LADDER SCAFFOLDS

GERMANY

“ 56. (1) Simple ladder scaffolds shall only be used for work requiring little material (minor repairs, washing, painting).

(2) Ladders shall be so erected on ladder shoes or planks that the uprights rest their whole weight equally on them.

(3) A ladder used to extend another shall overlap at least 2 m., and the two shall be lashed together by a combination of strong iron ladder clamps and other means, e.g. ropes.

(4) The scaffolding ladders shall be securely lashed to the building.

(5) Side displacement shall be prevented by diagonal bracing affixed to every second storey, or extended over the whole scaffold.

(6) All junctions or crossings of scaffold parts shall be screwed.

(7) If a ladder scaffold does not allow of safe ascent and descent, special ladders shall be affixed aslant, provided that the firmness of the scaffold is not thereby endangered.

(8) Intermediate working platforms up to 50 cm. wide shall be provided with guard-rails and intermediate rails; and such platforms over 50 cm. wide shall be provided with guard-rails and toe-boards.”

(R. 1.1.1930.)

AUSTRIA

8. “ Ladder scaffolds shall be reinforced by diagonal wind-bracing and be protected against falls by guard rails on the outside, and, if the free space between the scaffold and the building wall exceeds 0.4 m., on the inside also.

The boards shall rest on the rungs and shall project at least 0.2 m. on both sides.

The fastening of the ladders to the outriggers, and of the guard-rails to the ladder uprights shall be effected securely and durably.”

(O. 7.2.1907.)

UNITED STATES

Ohio, Pennsylvania

For *Ladder Jack Scaffolds* see under § 2 (f) “ Bracket Scaffolds ”.

FINLAND

“ 24. Ladder . . . scaffolding shall not be used more than 5 m. above the ground for any other work than pointing, washing down, painting, sheet metal working or other similar work, or incidental plastering and repairing.

Ladder scaffolding shall be braced or strutted or attached to the wall to prevent its collapse if the staging is laid on the rungs of the ladders. . . ”

(Res. 15.11.1927.)

FRANCE

“ Vertical ladders used in constructing light scaffolds shall be firmly fixed at different heights and carefully braced.”

(D. 9.8.1925, 26.11.1934, sec. 37.)

LUXEMBURG

“ . . . ladder scaffolding shall not be used except for light work such as roofing, plumbing, plastering, painting or repairing which does not require the use of heavy loads of materials.”

(O. 28.8.1924, sec. 11.)

POLAND

"18. (1) Ordinary ladder scaffolds may be used for work that requires little material (white-washing, light repairs, painting, etc.).

(2) The ladders shall be so installed as to render impossible the simultaneous vertical displacement of the two feet, and *a fortiori* the displacement of one foot with regard to the other.

(3) The ladders shall not be more than 2 m. apart. Scaffolds supported by single ladders shall be allowed up to a height of 16 m. For greater heights, ladders shall be employed in pairs and placed side to side.

(4) When one ladder is extended by another, the length of the join shall not be less than 1.80 m. The join shall be effected by means of double iron dogs and in addition, iron straps or stirrups.

(5) The ladders shall be firmly secured to the building by means of iron wire at least 2 mm. in diameter wound four times round the hooks; the hooks shall be at least 0.20 m. long and shall be let into the wall to a depth of at least 0.15 m. Other methods of fastening the ladders shall be allowed provided that they offer sufficient guarantee of safety.

(6) In order to prevent lateral displacement of ladders, the scaffolds shall be reinforced by means of diagonal bracing. The bracing shall be placed at least every two storeys and fastened by means of nails or screws to the uprights of the ladders.

(7) The thickness of the platform planks shall be 50 mm. Planks shall only be joined over the rungs and each plank shall overlap the next at least 0.20 m. It shall be prohibited to replace rungs by laths.

(8) The platforms on which the work is done shall be provided at a height of 0.90 m. above the floor with a handrail made of planks at least 32 × 150 mm. fastened with nails 70 mm. in length. Instead of being fastened by means of nails, the handrail may be secured to the ladders by means of iron wire 4 mm. in diameter tightly wound round four times cross-wise; or the handrail may be fastened to special plates provided for this purpose on the ladders."

(D. 23.5.1935.)

SWITZERLAND

Zurich

"42. Ladder scaffolds¹ (boards laid on ladders) shall be prohibited for work at a height of over 5 m. The points of support shall not be more than 2 m. apart; the boards shall be at least 30 cm. wide and 36 mm. thick.

Independent ladder scaffolds shall be fastened at the top of the ladders with cords or be well braced and stayed.

For ladder scaffolds, trestle ladders shall be used that are provided with a device preventing inadvertent spreading.

The provisions of section 42 shall also apply to foot and trestle ladder scaffolds outside the building."

(R. 31.1.1931.)

CZECHOSLOVAKIA

"29. (1) Simple ladder scaffolds shall be used exclusively about existing buildings, and only for light work executed with small quantities of materials, e.g. plastering, painting, limewashing and the like.

(2) The ladders shall have sufficiently strong uprights made of straight-grained sound wood, and shall not stand directly on the ground, pavement, etc., but shall be sunk into the ground for a sufficient distance. Where this is not possible, they shall be erected on a firm board flooring so that the two uprights of the ladder rest their whole weight equally on the flooring. Further, the slipping of the ladders off the flooring shall be prevented by suitable anchoring. The top of the ladders shall be firmly and permanently fastened; and if

¹ Inside scaffolds.

needles are used for this purpose, they shall be properly anchored. The ladders shall not be more than 4.5 metres apart.

30. (1) If a ladder is used to lengthen another, the two ladders shall overlap by at least 1 m. to 1.5 metres, and shall be properly fastened together (by iron hooks, butt straps, screws, cords or the like).

(2) The ladder scaffold shall be securely and permanently fastened to the building, especially the end and corner ladders. Provision shall also be made for proper longitudinal reinforcement of the scaffold.

(3) Lateral displacement of the scaffold shall be prevented by diagonal wind braces, which shall be placed at least at every second storey, extend over the whole length of the scaffold, and be securely fastened to the uprights of every ladder.

31. (1) The scaffold boards shall be of adequate thickness and approximate in width to the length of the ladder rungs. They shall be fastened with care. If special brackets (so-called sills) are not used to support the boards, these shall rest securely on the rungs and shall project beyond the ladder at least 20 cm. at each end, but not more than 50 cm. at the end of the scaffold.

(2) The brackets for the flooring shall be properly hung and securely fastened.

(3) The scaffold shall be erected so that wherever possible it is close to the wall, so as to prevent falls of persons or materials between the scaffold and the building.

32. (1) On the outer side the scaffold shall be enclosed by a guard-rail with at least two horizontal bars. If the space between scaffold and building is more than 40 cm., the scaffold shall be similarly protected on the inner side also. Preferably the guard-rail should be fastened to iron brackets screwed on to the ladder uprights.

(2) If the scaffold itself does not allow of safe ascent and descent, special ladders for these purposes shall be fixed from stage to stage.

(3) As a protection against falling objects, a protective roof at the requisite height above the ground shall be erected over frequented places; it shall slope moderately towards the building or the street, but in the latter case shall be fitted with a fender board."

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

" 84. The use of ladder scaffolds shall be permitted only for plastering, painting and similar work for which no heavy materials are required on the scaffolds.

85. The following rules shall be observed in the use of ladder scaffolds:

(a) The lower extremities of the ladders shall rest on solid wooden sole-plates laid on the ground.

(b) The ladders shall be securely fixed to solid parts of the building, according to their height.

(c) Once they are in place, the ladders shall be secured by means of struts and by diagonal and horizontal bracing.

(d) When ladders are joined end to end, the join shall be made by iron straps and bolts; when the ends overlap, the join shall be made by clamps and bolts. In the latter case, the length of the overlap shall not be less than 1 m."

(O. 5.5.1930.)

URUGUAY

" Scaffolds on ladders shall not be used for other than light work (plumbing, painting, etc.). They shall have guard-rails in conformity with section XI¹ and shall be securely anchored to the building. The ladders shall extend not less than 0.80 m. above the topmost platform."

(D. 14.4.1915, sec. XV.)

¹ See under § 2 (a) " Pole Scaffolds ".

YUGOSLAVIA

" 117. Ladder scaffolds shall be strengthened by diagonal ladders of adequate strength. They shall have a guard-rail on the outer side, and also on the inner side if the space between the scaffold and the wall exceeds 40 cm."

(R. 25.10.1921.)

(c) OUTRIGGER SCAFFOLDS

GERMANY

" 46.

(3) Where it is very difficult to erect a pole scaffold, a cantilever scaffold shall be erected as a protection.

(4) The topmost stage of pole or cantilever scaffolding shall not be more than 4 m. below the actual workplace.

60. (1) Only iron girders or timber in one piece shall be used as outriggers. The outriggers shall extend inside the building at least to the width of the outside scaffolding, have the inside end held down by props, be lashed to the joists or other firm parts of the building, and be secured against displacement.

(2) It shall be prohibited to secure outriggers merely by wedging them in the wall."

(R. 1.1.1930.)

AUSTRIA

" 7. In the case of outrigger scaffolds the inner ends of outriggers shall be held down by secure anchorages, or the outer ends shall be supported from the wall by sufficiently strong stays; and lateral displacement shall be prevented by suitable bracing."

(O. 7.2.1927.)

CANADA

Alberta

" Scaffolds shall not be used by workmen where their main support is a strut or brace running from the inner angle of the bracket to the ground. The drop ledger scaffold shall not be used for carrying material when workmen are employed thereon. When the drop ledger scaffold is used, it shall be constructed as follows: The suspension pieces shall be fastened at top between two cantilever beams, spiked together, bottom strut to be fastened to suspending pieces not more than 4 ft. from the cantilever beam, and to have a cleat securely fastened underneath. All pieces to project 1 ft. beyond points of fastening, except the wall side of bottom struts. Platform planks shall not be less than 2 x 10 in. material, free from defective knots and shakes. Cantilever timbers shall be not more than 8 ft. apart, and the inner platform planks not more than 6 in. from the wall. Cantilever beams shall be counter-balanced inside the building, either by compression struts, ties or sufficient counter-weights. All pieces used in scaffolding shall be 2 in. by 6 in. or larger dimension timbers, and securely spiked at points of fastenings."

(R. 31.7.1928, sec. 171.)

UNITED STATES

California

" Order 1126. (a) All outriggers' scaffolds intended to be used by bricklayers, stone masons or stone cutters, shall be made of sound lumber not less than

three by ten (3×10) inches or other approved material of equivalent strength. Such outriggers shall not project more than six (6) feet from the outer face of building and shall be substantially braced and secured to prevent tipping or turning. The platforms shall be made of sound Oregon pine or other approved material of equal strength not less than two (2) inches thick, laid close. The outside of the platform shall be provided with a substantial railing of iron or wood, not less than three feet six inches ($3'6''$) high, and provided with a toeboard not less than six (6) inches high. The space between the toeboard and the railing shall be filled in with canvas or wire netting of not more than one-half ($\frac{1}{2}$) inch mesh.

(b) Figure four, or light outriggers' scaffolds: 1. Whenever figure four or light outrigger scaffolds are used to project through windows or other openings, said figure four or light outrigger scaffolds shall be spaced not more than eight (8) feet apart, and shall be constructed of sound lumber, and as follows: 2. For openings up to six (6) feet in height, two by four (2×4) inch uprights or heavier material shall be used. For openings greater than six (6) feet in height, two by six (2×6) inch or heavier uprights shall be used. 3. All putlogs or ledgers shall be at least one by six (1×6) inch lumber and shall project at least four feet six inches ($4'6''$) from the outside wall line. The putlogs and ledgers shall be securely fastened or nailed to uprights. The knee or angle brace shall intersect putlogs or ledgers at least four (4) feet from the wall, and shall intersect uprights as close to the sill lever as possible. All joints and parts thereof must be adequately secured to prevent collapsing. 4. A one by six (1×6) inch spreader shall be nailed at the upper end of uprights and heels shall be securely blocked to floor by at least two (2) inch blocks. Figures shall be braced on the outside to prevent swaying, tipping or collapsing. 5. All platforms shall be made of at least two by eight (2×8) inch planks and shall be at least two (2) feet wide."

(S.O. 1.7.1926.)

Ohio

"Section 192. Outrigger or thrustout members shall be constructed in compliance with the provisions for allowable loads and stresses in sections 23¹ and 157,² shall conform to the general requirements for masons' pole scaffolds and shall not project more than six (6) feet from the outer face of the structure. The strength of outriggers or thrustouts shall be not less than a two by ten (2×10) inch timber on edge.

Section 193. Working platforms suspended from outriggers shall have suspension frames, the vertical members of which shall be not less in size than two (2) inch by six (6) inch timber extending not less than ten (10) inches above the tops of outriggers and fastened to the outriggers by shoulder blocks resting on the outriggers and fastened to the vertical members. Such blocks shall be not less in size than two (2) inch by six (6) inch by eight (8) inch timber. The bottom ends of vertical members shall extend not less than ten (10) inches below the bottom of bearers and shall be fitted with shoulder blocks the same as provided above, upon which the bearers shall be set. The bearers shall be not less in size than two (2) inch by six (6) inch timber. The suspended frames shall be securely and substantially braced to prevent excessive sway. Other types of suspended outrigger scaffolds may be used, provided they comply with section 192.

Section 194. The platform shall consist of not less than three 2×10 inch planks, laid as provided in section 145.³

Section 195. Outriggers shall be securely supported, held and fastened in place at their inner ends and in the openings through which they project by means of U-bolts, spikes, bolts, lashings, anchoring or other equivalent means.

¹ Not reproduced.

² See under § 1 (c) "Scaffold Materials and Construction".

³ See under § 4 (b) "Gangways, Runs", etc.

Section 196. Thrustouts shall not be built into a wall and left with no other support, but shall project entirely through the wall or through windows and be solidly supported and substantially braced.

Section 197. Where pyramiding or built-up scaffolding is done on an outrigger or where it is necessary to extend the outrigger more than six (6) feet beyond the face of the structure the beams shall be of steel or extra heavy timber and shall be substantially supported and securely fastened as required in sections 195 and 196. In such cases the scaffold proper shall conform to the requirements for pole scaffolds.

Section 198. Guardrails, toeboards, side screens and overhead protection shall be provided as specified in sections 239 to 245 ¹ inclusive and sections 254 and 255 ² of this code."

(S.R. March 1931.)

Pennsylvania

"Rule 8. (a) The platform of outrigger scaffolds shall consist of planks at least ten (10) inches in width and two (2) inches in thickness. They shall be laid tightly together and shall overlap their supports at least four (4) inches, but not more than six (6) inches. In building the platform, provision shall be made for the erection of guard rails and toe boards.

(b) Thrustouts shall not be built into a wall and left with no other support, but shall project entirely through the wall or through windows and be solidly supported and substantially braced inside of the building. External supports shall also be provided.

(c) Where pyramiding is done on outrigger scaffolds the beams shall be of steel or extra heavy timber and be substantially anchored and braced, inside and outside the building. In such cases, the scaffold proper shall conform to the requirements for single pole scaffolds as set forth in Rule 2.³

(d) Protection shall be provided as set forth in Rule 23.⁴"

(R. 1933, Rule 8.)

FINLAND

"24. Ladder, suspended and mast scaffolding shall not be used more than 5 m. above the ground for any other work than pointing, washing down, painting, sheet metal working, or other similar work or incidental plastering and repairing.

In jib scaffolding, where the staging is supported by jibs, the inner end of the jibs shall be anchored to the opposite wall or to some other firm part of the building, and the outer ends of the jibs shall be supported by braces with bearings in the wall. The said braces shall not rest on ledges or projections, but shall rest in recesses in the wall or on a plank secured to the wall.

If another free scaffold is erected on a jib scaffold, the height of the former shall not exceed 3.5 m.

Jib scaffolds may be used as bricklayers' scaffolds, subject to the consent of the industrial inspector."

(Res. 15.11.1927.)

FRANCE

"34. The supports of fixed overhanging scaffolds shall be of large cross-sectional area if they are made of wood, and of large section if they are made of iron. The inner ends of these pieces shall be firmly held in position. Only firm parts of the structure shall be used as points of support for any part of the scaffold.

¹ See under § 1 (c) "Scaffold Materials and Construction".

² See under § 6 (c) "Catch Scaffolds and Protective Roofs".

³ See under § 2 (a) "Pole Scaffolds".

⁴ See under § 6 (c) "Catch Scaffolds and Protective Roofs" and § 8 (c) "Protection of the Public".

35. Light cantilever scaffolds constructed on walls without the use of uprights shall not be supported by bars sealed in the wall unless the latter is at least 35 cm. thick, in which case the sealing shall be at least 16 cm. deep. The iron bars used in the construction of these scaffolds shall be of large sections and only beams of stout timber shall be used instead of such bars. The free end of each bar, which shall be provided with an eye, or of the timber support, shall be fastened by ropes to a firm part of the structure or supported by a strut."

(D. 9.8.1925 — 26.11.1934.)

GREAT BRITAIN

"24. Cantilever or jib scaffolding shall be constructed of materials of adequate strength, securely fixed and anchored from the inside, and of sufficient length to ensure stability and shall also be properly braced and supported.

27. *No working platform resting on wooden bearers let into the wall at one end and without other support shall be used unless the bearers go right through the wall, are securely fastened, and are of sufficient strength."*

(R. 21.6.1926.)

IRISH FREE STATE

As for *Great Britain*.

POLAND

"19. (1) The outriggers of outrigger scaffolds shall be in squared timber, and shall have a cross section of at least 0.14×0.14 m. They shall be inclined 1 per cent. towards the wall, and shall not project more than 1.50 m. beyond the outside of the wall. Outriggers shall be carried through the wall or through openings to the inside of the building, and shall extend at least 2 m. beyond the inside face of the wall. The ends of the outriggers inside the building shall be anchored to the ceilings. The platforms, guard-rails and toe-boards shall satisfy the requirements laid down in section 14¹ for pole scaffolds.

(2) Dimensions other than those specified above shall not be allowed unless they have been shown in a special plan, accompanied by static calculations, and approved by the competent building authority."

(D. 23.5.1935.)

SWITZERLAND

Geneva }
Zurich } See under § 2 (e) "Suspended Scaffolds"

CZECHOSLOVAKIA

"28. (1) Cantilever scaffolds shall be used only for repairs, painting and limewashing, cleaning, adding new storeys to buildings and minor constructional work on existing buildings. In the erection of new buildings, such scaffolds shall not be used unless there is no room for scaffolds with poles or standards, e.g. owing to the proximity of the adjoining buildings in the case of work on gables, fire walls, etc.

(2) The scaffolding shall not be less than 2 m. wide; if an auxiliary scaffold is erected on it, it shall not be less than 3 m. wide. Only in the case of protective cantilever scaffolds (subsection (2) of section 22²) shall a minimum width of 1.5 m. be allowed.

¹ See under § 2 (a) "Pole Scaffolds".

² See under § 6 (c) "Catch Scaffolds and Protective Roofs".

(3) The needles for cantilever scaffolds shall be very securely anchored inside the building or lashed to the beams, as the case may be, and shall be secured against any displacement or outward pull. Outside the building, at least every other needle shall be supported from the wall by sufficiently strong bracing. This bracing shall not be omitted unless use is made of particularly strong needles supported over a sufficient length and lashed to the framework of the ceiling so that in conjunction with the ceiling joists they form a stable unit. The outside board of the flooring shall be firmly fastened to every needle. The open sides of cantilever scaffolds shall be fenced in the manner prescribed above for pole scaffolds.

(4) Trestles placed on cantilever scaffolds shall be erected and fastened with particular care."

(O. 26.3.1931.)

(d) RIVETERS' SCAFFOLDS

UNITED STATES

California

"Order 1132. (a) All riveters' scaffolds shall be suspended by not less than one and one-quarter ($1\frac{1}{4}$) inch diameter manila rope, or its equivalent, and so secured to the beams or girders as to prevent them from slipping.

(b) All ropes shall be free from acids, flaws or other imperfections.

(c) The needle beams shall consist of not less than four by four (4×4) inch lumber or three (3) inch pipe, or heavier material.

(d) Each platform of the scaffold in the interior of the building shall be at least two (2) feet wide, and on the outside at least three (3) feet wide, made of planks two (2) inches in thickness or heavier, and shall be so secured by suitable cleats or drop bolts or other means to prevent them from slipping, tipping or collapsing."

(S.O. 1.7.1926.)

Ohio

Ironworkers' (Needle Beam) Scaffolds

"Section 211. For riveting, drilling or other work on structural steel where flooring has not been completed the scaffold shall be constructed to carry the imposed load with a safety factor of four (4).

Section 212. Needle beams not more than ten (10) feet in length shall be of sound wood, four by six (4×6) inches in cross-section, or other material of equal or greater strength, two feet longer than the distance between supports, shall be one solid piece without splicing and provided with means to prevent supports slipping over the ends. When conditions require longer beams, the cross-section shall be increased in accordance with the length of the beams and the weight to be supported, or a center support or hanger for needle beams provided every eight (8) feet. Suspending members shall meet the requirements of section 28¹ and shall be securely fastened to the beams or girders to prevent slipping.

Section 213. Platforms shall be not less than three (3) ten (10) inch planks inside and outside of the building, unless space will not permit. Planks used for platforms shall meet the requirements for allowable loads and stresses as provided in Sections 23² and 157³ of this code.

Section 214. Needle beams shall be securely and substantially held in place, and platform planks shall be secured to such beams by substantial cleats, drop bolts, lashings or other safety devices to prevent them from slipping, tipping or shifting. Where the planks to be used are in a steeply inclined position they shall be provided with cleats to insure a safe foothold.

¹ See under § 5 "Ropes and Chains".

² Not reproduced.

³ See under § 1 (c) "Scaffold Materials and Construction".

Section 215. Where one end of the needle beam is supported on the structure it shall have a bearing surface equal to its width. If the end does not project at least six (6) inches beyond the supporting member it shall be lashed or otherwise secured against possible shifting.

Section 216. Unless space will not permit, rivet-heaters' platforms shall be constructed of two (2) inch planks laid close together, not less than ten (10) feet long by six (6) feet wide and provided with standard toeboards."

(S.R. March 1931.)

Pennsylvania

"Rule 9. (a) Where the space between needle beams is twelve (12) feet or less, the platform shall be composed of planks at least ten (10) inches wide and two (2) inches thick. Where the span is over twelve (12) feet the cross section of the two planks shall be increased in proportion. Platforms shall not be more than six (6) feet in width. In all cases where not nailed or otherwise secured, planks shall be at least two (2) feet longer than the span bridged and a hole shall be bored through both ends of every plank. The hole shall be not less than six (6) inches from the end and a five-eighths ($\frac{5}{8}$) inch bolt at least eight (8) inches in length shall be placed therein and provided with a tightly fitting nut. The planks shall be laid on the beams with the bolts outside. Where the planks are to be used in a steeply inclined position, they shall be provided with cleats at least one and three-fourths by two ($1\frac{3}{4} \times 2$) inches in cross section spaced not more than eight (8) inches apart. Provision shall be made for the use of guard rails and toe boards.

(b) All needle beams shall be plainly marked so as to provide against being used for any other purpose. Care shall be taken in handling them to prevent falls and ensuing defects. Up to twelve (12) feet in length wood needle beams shall be at least three by eight (3×8) inches in cross section; for longer spans or heavier loads the cross section shall be proportionately increased. All needle beams shall be at least two (2) feet longer than the distance between the supports and shall be of one solid piece without splicing. Provision shall be made to prevent the supporting ropes from slipping over the ends of the beams.

(c) Pipe needle beams shall be of unspliced wrought iron or steel pipe, painted and free from rust or scale. When the scaffold span is not more than twelve (12) feet, the pipe shall be at least three and one-half ($3\frac{1}{2}$) inches in diameter; if the span be more than twelve (12) feet and not more than sixteen (16) feet the pipe shall be at least four (4) inches in diameter; over sixteen (16) feet the diameter of the pipe shall be correspondingly increased.

(d) The ropes shall be attached to the needle beams by what is known as a "scaffold hitch" or some other equally effective method, the loose end being firmly tied to a supporting rope by a bowline knot. The rope shall be at least one ¹ inch in diameter and shall be increased proportionately to the size of the load. The supporting rope shall not be attached to the needle beam at a point less than one (1) foot from the end of the beam. In other respects the rope shall conform to the requirements set forth in Rule 21 ¹.

(e) Protection shall be provided as set forth in Rule 23 ² on Protection."

(R. 1933.)

(e) SUSPENDED SCAFFOLDS

GERMANY

"57. (1) New types of suspended scaffolds shall not be used for the first time without the previous approval of the Executive of the Mutual Accident Insurance Association. The Executive may require the relevant

¹ See under § 5 "Ropes and Chains".

² See under § 6 (c) "Catch Scaffolds and Protective Roofs" and § 8 (c) "Protection of the Public".

plans and calculations.¹ The use of previously approved suspended scaffolds at another workplace shall be notified in advance.

(2) Suspended scaffolds shall only be used for work requiring little material, and only then when the erection of another type of scaffold would be attended by considerable difficulties owing to local conditions.

(3) The safety of scaffolds shall be tested before every occasion of use.

(4) Precautions shall be taken against the scaffold's swinging.

(5) At particularly conspicuous places on the scaffold there shall be affixed cautionary notices showing the maximum authorised load, and prohibiting unauthorised loads and unauthorised methods of use.

(6) As far as possible, insured persons employed in erecting and dismantling scaffolds shall rope themselves.

58. (1) Immediately after being placed in the suspension (supporting hooks), the platform supports shall be hung at the points of support in wire ropes or in a second hook.

(2) Use shall only be made of suspension hooks that have been bent hot.

(3) The stages (working platforms) shall be as horizontal as possible, and, if necessary, stepped.

(4) At least one communication ladder shall be provided for every twenty insured persons. Communication ladders shall be erected at adequate distances from one another.

59. (1) For supporting suspended scaffolds travelling vertically, use shall be made of outriggers having at least a tenfold margin of strength, and specially secured against displacement, tilting and overturning.

(2) The hooks of the winding ropes shall be so lashed to the supporting straps of the scaffold that they cannot slip out.

(3) The joining of two suspended scaffolds by a so-called bridge, and the use of ladders on suspended scaffolds, shall be prohibited.

(4) Such scaffolds shall be provided on all sides with guard-rails, intermediate rails, and toe-boards."

(R. 1.1.1930.)

AUSTRALIA

New South Wales

Light Swinging Stages

3. (a) (Definition.)

(b) (Authorisation of Chief Inspector required for any deviation from the rules.)

(c) (Use of light swinging stages prohibited in dangerous or unsuitable conditions.)

(d) (Swinging stages not to be overloaded.)

¹ "As a general rule, the suspension hooks, wire ropes, platform supports, and cross bars shall be designed for:

(a) an equally distributed full load of at least 60 kg. per square metre, and, in addition,

(b) a single load of 250 kg., at the most unfavourable place.

Dimensions of the scaffold flooring shall, as a rule, be based on the assumption that a single load of 125 kg. will be placed at a most unfavourable place.

The weight of the scaffold parts themselves shall always be added to the working load. If the scaffold is not protected against rain, the weight of the wooden parts shall be taken as double their weight when dry. The suspension hooks shall be tested as to strain and bending, and shall be tapped before use for the purpose of discovering concealed defects."

“(e) The factors of safety indicated hereafter and based upon the ultimate strength of the part or member named shall be provided for every light swinging stage constructed and erected:

	Part or member	Factor of safety
(i)	Steel needles; steel fittings, and bolts attaching needles to supports or to the building or structure	Four (4)
(ii)	Steel structural members in platform	Four (4)
(iii)	Steel wire suspension ropes; fitting and attachments for ropes, all portions of operating and winding mechanism.	Six (6)
(iv)	Timber used for supporting and transferring counter-balance load to needles	Six (6)

(f)(i) Steel wire ropes of adequate flexibility for their purpose may be used for light swinging stages, and the ultimate breaking strength of every such rope shall not be less than six times the maximum load to be imposed.

(ii) Manilla rope may also be used for light swinging stages, but such rope shall be not less than 2½ inches in circumference, and shall be served through a double and single block so as to provide four parts of rope.

(iii) All spliced eyes in steel ropes or manilla ropes shall be round thimbles and shall have not less than three full tucks.

Steel ropes shall be kept in good condition and any rope showing indications of excessive wear, rust, splintering, stranding, or bunching must be at once replaced by new rope.

Every steel rope must be secured in a positive and effective manner to a safe anchorage and to the Inspector's approval.

Manilla ropes that have become excessively worn or have been adversely affected by the weather or by water, or which have come in contact with or been affected by acid or other corrosive or destructive agent, shall be immediately discarded.

Block sheaves shall be not less than 4 inches diameter, and the cheeks of the blocks shall be of iron or steel or, if of wood, shall be reinforced with steel straps.

At all times other than when the stage is being raised or lowered, the hauling part of manilla rope is to be secured by passing it through the hanger and made fast with a blackwall hitch to the hook of the lower block, the free end to be safely made fast to the handrail or hanger.

(iv) Immediately prior to the erection of the stage and at frequent intervals thereafter, the person actually responsible for the erecting of the stage or the person in charge of the work, as the case may be, shall inspect all parts of the stage and its supports, and satisfy himself as to its safety and conformance with this Regulation.

(g) A winch or similar machine shall not be used in conjunction with a light swinging stage unless:

- (i) a design, or
- (ii) a sample together with a description in writing of the manner in which the winch or machine is to be set up, maintained, and used,

has previously been submitted to and approved by the Chief Inspector.

All winches or machines shall be set up, maintained, and used as provided for in the design or description approved by the Chief Inspector, and while in use shall be kept lubricated and maintained in an efficient state of repair free from accumulation of dust, dirt, or foreign matter.

The pawls of every such winch shall have effective provision for preventing the pawls inadvertently getting out of engagement. All handles shall be kept

in position with nuts, split pins, or collars and set screws, or other means approved by the Chief Inspector. The faces or ratchets, clutches, gear locks, and collars shall be kept square. Wheels and pinions shall be kept in good condition properly keyed up and in correct gear relationship. All parts so worn as to constitute conditions of hazard or danger shall be immediately replaced by new parts. Pegs, dovetailed or welded teeth in gear wheels or ratchets are hereby prohibited.

(h) Needles shall either be firmly secured to the building or structure, with bolts, suitable steel fittings, or lashing. In every such method a factor of safety of at least four (4) shall obtain, or be counterbalanced with material firmly placed upon or secured to the needles in a manner which will prevent such counterbalance accidentally shifting or being inadvertently removed, or by weights lashed to the needles. Water or other liquids must not be employed for counterbalance.

Provision shall be made to prevent needles turning over or moving laterally, and any planking, platform, or other structure provided for supporting needles or the counterbalance on needles, shall have the necessary strength and be capable of sustaining the maximum weight imposed without undue deflection.

The net weight of counterbalance on any needle shall not be less than three times that necessary to balance the load on the projecting part of the needle should the stage be fully loaded. In calculating such net weight of counterbalance, due regard shall be given to the points of suspension of the stage, the disposition of the counterbalance, and the point of substantial bearing of the needle between same.

Parapet hooks shall not be used for purposes of suspending a light swinging stage.

(i) Blocks shall be securely attached to the ends of the needles by a steel fitting secured to the needles and providing a factor of safety of at least six (6), or be adequately secured to the needle by lashing.

(j) No person under the age of eighteen years, and no persons other than those specially authorised by their employer so to do, shall work or interfere with a winch or similar machine used for raising or lowering a light swinging stage, and no person shall employ, instruct, or direct any person under the age of eighteen years to act in contravention of this provision.

Ropes shall be evenly wound on the drum and not more rope than can be accommodated between the cheeks shall be wound on the drum.

The handles of the machine when not actually in use for raising or lowering shall be left in that position which will prevent the platform from descending.

(k) In raising or lowering a light swinging stage the process shall be carried out in such a manner as to ensure that the platform shall remain substantially level.

(1) Timber needles used for a light swinging stage shall in no case be of less section than 6 in. \times 4 in. and shall be placed on edge; and be of timber at least equivalent in strength to Oregon pine of the best quality, and be of straight grain and free of knots, cracks or shakes.

Where needles of the above minimum section are used the point of suspension of the stage shall not be more than 2 ft. from the point of bearing of the needle on the building or structure.

If the distance between the points of suspension of the stage and of bearings on the building exceeds 2 ft., the section of the needle shall be increased; the transverse strength of such section to bear the same proportion to a 6 \times 4 in. section on edge as the distance between the points referred to does to 2 ft.

Where timber needles are counterbalanced their length shall not be less than 12 ft. and not less than 9 ft. of the length must be on the counterbalanced side.

The platform of a light swinging stage shall be not less than 20 in. nor more than 24 in. in width, and shall be formed of straight-grained planks 1½ in., thick, running the full length, and stiffened with strong cleats fixed at the centre and immediately adjacent to each hanger.

The total length of the stage shall not exceed 18 ft. The distance between hangers shall not exceed 12 ft. and the overhanging at each end shall not exceed one quarter of the distance between the hangers.

The hangers shall be formed of steel 1 in. diameter, or 2 in. by $\frac{1}{2}$ in. steel and shall pass under the planks and be securely attached to same. The width of the hangers shall not exceed that necessary to neatly accommodate the full width of planking.

A guard rail of 3 in. \times 2 in. straight-grained Oregon, or of water pipe of 1 in. internal diameter, or of section and material ensuring equivalent strength and stiffness for the span, securely fastened to the hangers and at not less than 30 in. above the planking, shall be provided on the outer side of the platform.

A fender board of not less than 6 in. \times 1 in. section shall be provided and securely fixed on edge on the outer side of the platform in all cases, and where material or tools are to be loosely placed on the platform a fender board of similar section is to be provided on both sides and the ends."

Suspended Scaffolding

3 A. (a) (Definition).

(b) (Authorisation of Chief Inspector required for any deviation from the rules).

(c) (Use of suspended scaffolding prohibited in dangerous or unsuitable conditions).

(d) (Suspended scaffolds not to be overloaded)

(e) (Similar to paragraph (e) of regulations for "Light Swinging Stages").

Wire Ropes for Suspended Scaffolding

(f) (Similar to paragraph (f) of regulations for "Light Swinging Stages").

Suspended Scaffolding Machines

(g) (Similar to paragraph (g) of the regulations for "Light Swinging Stages").

Fixing and Securing of Outriggers for Suspended Scaffolding

(h) Outriggers shall be provided with a firm and substantial support, and such support shall be so arranged that the projecting or cantilever portion of each outrigger shall be as short as practicable.

The inner end of each outrigger shall—

(i) be secured to the building or structure with bolts or other suitable fittings; such bolts or fittings and the portions of the building to which they attach shall provide a factor of safety of at least four under maximum conditions of loading; or

(ii) be counterbalanced with bricks, squared stones, concrete blocks or other building material of a like nature, or by specially constructed counterweights or bags of sand.

Material provided for counterbalance shall be so placed or secured that it cannot be accidentally or inadvertently shifted from its position, and any planking or platform provided for supporting such material shall have the necessary strength and be capable of transferring the weight of the whole of the counterbalance of the outrigger without material deflection occurring.

Any platform or structure or beam, bearer or other structural member used for supporting an outrigger and the loads therefrom, or any counterbalance; or used for supporting and transferring the weight of counterbalance to the outriggers, or used for transferring the loads from an outrigger to portion of the building, shall be such that a factor of safety of at least six shall obtain in all parts of timber, to withstand the resultant loads from the outrigger when (a) the suspended scaffolding is fully loaded, and (b) when

no load is imposed on the outrigger from the scaffold, and shall be so constructed or so fixed and secured that lateral movement in any direction cannot occur.

Where shores from a higher floor or steel framing of a building are used in place of counterbalance, such shores must be positively secured in their correct position so that no lateral movement can occur, and they must be so placed and fixed that they cannot impose any undue load on any part of the structure supporting the outrigger.

Any bolt used for securing an outrigger or used in the supporting structure of an outrigger or for securing bracing or a shore or other structural member shall not be less than $\frac{5}{8}$ in. in diameter and shall be provided with washers.

The net weight of counterbalance on any outrigger shall not be less than three times that necessary to balance the load on the projecting part of the outrigger should the scaffolding be fully loaded, due regard shall be given to the points of suspension of the scaffolding, the disposition of the counterbalance, and the point of substantial bearing of the outrigger between same.

Straps for Attaching Suspended Scaffolding to Outriggers

(i) A mild steel or wrought iron strap formed of a section not less than 2 in. by $\frac{3}{8}$ in. shall be provided to the outer end of every outrigger for purposes of attaching the fall or blocks, and such straps shall be a close fit to the top and sides of the outrigger, and from the bottom of the section make an angle of not less than 75 degrees with the bottom of the outrigger until the inside faces of the two parts of the strap are within 1 inch of each other, then to be formed vertical, such vertical portions to be parallel for not less than $2\frac{1}{2}$ in. and drilled to take a $\frac{3}{4}$ in. steel bolt, the centre of which hole shall not be less than 1 in. from the bend. A $\frac{3}{4}$ in. steel bolt shall be provided through these holes with a nut, the end of the bolt to be riveted over, or a split pin provided through the bolt end outside the nut.

The strap shall be secured to the outrigger by a bolt through the sides of the strap and mid-section of the outrigger, or by a bolt on the outer side of the strap.

Use of Suspended Scaffolding Machines

(j) (Similar to paragraph (j) of regulations for "Light Swinging Stages").

Use of Suspended Scaffolding

(k) (Similar to paragraph (k) of regulations for "Light Swinging Stages").

General

(1) The steel outriggers shall be of a steel section at least equivalent in transverse strength to a $7 \times 3\frac{1}{2}$ in. \times 15 pounds British Standard section, and shall be at least 15 ft. long and shall not project more than 6 ft. 6 in. from the outside point of support on the building or structure. Outriggers shall not be spaced more than 10 ft. apart centre to centre.

The outriggers shall be securely fixed in the manner heretofore provided in these Regulations.

The total width of the platform staging shall not exceed 5 ft.

The staging shall be supported on steel bearers at least equivalent in transverse strength to $2 \times 2 \times \frac{3}{8}$ in. British Standard steel angles.

The staging shall be formed of closely-laid sound straight-grained Oregon pine planks not less than 2 in. thick.

The ends of the planks of each unit comprising four machines shall be cleated, such cleat to be of not less than $4 \times 1\frac{1}{2}$ in. timber or $2 \times \frac{3}{8}$ in. steel and placed near the ends of the planks and outside the steel bearers, and so arranged as to ensure that the ends of the planks cannot lose their bearing on the bearer. Each plank shall be secured to the cleat with bolts not less than $\frac{3}{8}$ in. diameter.

Each plank shall have an overlap of at least 12 in. beyond the supporting bearers.

A fender board of $9 \times 1\frac{1}{2}$ in. shall be firmly secured on the outside, inside and ends of the platform.

On the outside and at the ends of the platform a guard of straight-grained Oregon not less than 3×2 in. or water pipe of 1 in. internal diameter or manila rope of 3 in. circumference, or steel rope of $\frac{1}{2}$ in. diameter, shall be securely fastened and kept taut at a height of 3 ft. above the platform.

Where required ties between the platform and building shall be provided and fixed.

The weight of men and material on suspended scaffolding of the above description shall not in any one bay exceed 10 cwt. and the gross weight, that is, the weight of scaffolding platforms, machines, ropes and men and material on any one outrigger shall not exceed 15 cwt.

Boatswain's Chairs

3 B. (a) All overhead support for any boatswain's chair shall be safely secured in position and shall be of sufficient strength to sustain a load of not less than four times the weight to be suspended therefrom.

(b) Rope tackle used for supporting a boatswain's chair shall consist of four (4) parts of manila rope. Each part to be not less than $2\frac{1}{2}$ in. circumference, and reeved through a double and a single block.

The sheaves of such blocks shall be not less than 4 inches diameter. The cheeks of the blocks shall be of iron or steel, or, if of timber, shall be reinforced with steel straps.

(c) Immediately prior to the erection of a boatswain's chair, and at frequent intervals thereafter, the person actually responsible for the erection of the chair, or the person in charge of the work, shall inspect all ropes. Ropes that have been adversely affected by the weather or by water, or which have come in contact with or been affected by acid or other corrosive or destructive agent, shall be immediately discarded.

(d) In the construction of a boatswain's chair, four (4) parts of rope are to be used to support the chair proper, such rope shall be not less than $1\frac{1}{2}$ in. circumference."

(R. 17.9.1929, secs. 2, 3, 4.)

Queensland

Light Swinging Stages: Suspended Scaffolds

As for *New South Wales*.

Flying Stages

"14. Every flying stage shall be constructed by the owner thereof according to the following specifications:

- (i) Flying stages shall be constructed of 12 by 2 in. Oregon planking, 14 ft. long. Such staging shall be suspended by means of 2 in. Europe or manila tail-ropes attached to 1 in. circumference stage-ropes (steel) by means of eyes spliced in ends of ropes.
- (ii) Such stage-ropes shall be attached to planks by means of one full turn round plank, and be seized beneath plank and stapled in position to sides of plank.
- (iii) All flying stages shall be provided with spurs securely fixed to planks and sufficiently long to ensure effective working conditions.
- (iv) Where it is necessary for workmen to stand to their work upon flying stages, an efficient life-line must be provided."

(R. 25.2.1916.)

Western Australia

Similar to *Queensland*.

AUSTRIA

" 9. Suspended scaffolds shall only be slung from sufficiently strong and securely anchored outriggers by means of ropes. In the case of assembling work, chains and rigid iron rods of sufficient strength may be used instead of ropes.

The maximum number of men allowed on the suspended scaffold and the minimum authorised thickness of the suspension ropes shall be permanently and conspicuously indicated on the scaffold in legible characters.

Every winch shall be provided with a pawl and brake, and all toothed gearing with a protective cover.

Every suspended scaffold shall be secured against rocking by means of suitable devices."

(O. 7.2.1907.)

BELGIUM

" 8. . . . Hanging ladder scaffolds shall be firmly held by hooks and ropes. They shall be suitably lashed to the walls so as to avoid all side displacement. One of the uprights shall be fitted with securely fastened steps. This last provision, however, shall not be compulsory for plasterers' scaffolds."

(R.O. 31.3.1905.)

CANADA

Alberta

" 6. The following regulations shall be complied with in the erection, alteration, repair, improvement or demolition of every building, that is to say:

- (a) The floors of all scaffolding suspended from overhead shall be at least 2½ ft. wide and the floors of all standing scaffolding shall be at least 4 ft. wide; all such scaffolding shall, unless the same is dispensed with by written authority of the inspector, have a railing or guard not less than 3 ft. nor more than 4 ft. from the flooring on the outside of the scaffolding for the protection of persons working thereon;
- (b) Where scaffolding or staging is ' swung ' or suspended from an overhead support it shall be so secured as to prevent its swaying to and fro."

(Revised Statutes, 1922, chap. 193.)

" Roof hooks for the suspension of scaffolds shall not be hooked to a parapet wall or fire-wall, where the suspending rope or cable passes over a cornice, nor shall scaffolds be suspended from sheet-metal or wooden cornices."

(R. 31.7.1928, sec. 169.)

Manitoba
Ontario
Saskatchewan

} The regulations are similar to those in section 6 of the Revised Statutes of Alberta, 1922, ch. 193.

CHILE

" 392. Flying or suspended scaffolds may be constructed over public highways provided that they offer the necessary degree of safety and are provided with adequate outriggers. These scaffolds shall be compulsory over pavements less than 1 m. wide."

(R. 14.1.1930.)

SPAIN

"(1) Partly or entirely suspended scaffolds used for plastering or repairing frontages shall as regards their structure and parts satisfy the conditions laid down in the present Royal Decree and the general conditions of stability and strength.

(2) The outriggers shall preferably consist of rolled-iron bars of suitable section, so as to give a safety factor of not less than five with respect to the breaking load, calculated with due regard to the condition of the material in question.

In default of such outriggers in rolled-iron, timber may be used, always provided that it is sound, free from knots impairing its strength, and of the necessary cross section to give a safety factor not less than that required in the preceding paragraph.

(3) Balcony brackets and similar members serving to complete the stability of the scaffold, (notwithstanding that this stability always resides in the bearers carrying the whole assemblage) and the flooring, as regards supports, cables, chains, pulleys, straps, blocks and other suspension gear, shall always be capable, in respect of their section, dimensions and quality, of withstanding the mechanical stresses to which they will be subjected.

(4) The suspension ropes, as the principal elements of resistance in the assemblage, shall be of hemp, in good condition, and of the dimensions required by the magnitude of the weights suspended.

(5) The distance between any two platforms shall not exceed 1.80 m.

(6) To the scaffolds shall be attached one or more ladders, suitably secured, that give safe and easy access to them.

(7) The use of ropes for descending shall be prohibited, and it shall be compulsory to use a rigid guard rail, whether in one piece of timber or not, of sufficient strength and firmly secured, so as to prevent the fall of workers.

(8) The boards, planks or other members of any kind that form the floor of the scaffolds shall be secured in such a way that they cannot move or rock when walked upon.

(9) To prevent falls between the scaffold and the frontage, platforms of boards shall be placed in the gaps between the balconies of the storey immediately below that on which work is being done so as to break the fall in case of accident.

(10) The accumulation of materials on scaffolds shall be avoided; no more than is necessary for the work in hand shall be placed on them. The weight for the indispensable requirements of construction shall be taken into account in calculating their stability and strength.

(11) The width of the scaffold floor shall be that necessary to provide a stand for the workers and a place for materials.

(12) Workers who are not employed on the scaffold, but in erecting it, or who are on cornices, roofs or other parts of the building that present a risk of falls shall be lashed by safety belts, straps, ropes, etc., to firmly secured anchorages.

(13) Use shall not be made of completely or partially suspended scaffolds unless they have previously been examined by a Municipal Architect and unless this architect has issued a certificate to the effect that, in addition to complying with the provisions of the present Royal Decree, the scaffold satisfies general conditions of safety."

(R.D. 23.1.1916.)

UNITED STATES

California

"Order 1129. Bricklayers' or masons' suspended scaffolds.

(c) The thrustout shall be equal in strength to six (6) inch 12.25 lb. I-beams, and they shall be supported laterally at a point near the center of their length.

(b) The platform shall be suspended by cables at least equal to three-eighths ($\frac{3}{8}$) inch diameter standard crucible steel hoisting cable, secured to the thrustouts and to each end of the putlog or hoisting machine. All working parts of hoisting machines shall be exposed at all times so that defective parts can be easily seen and inspected. Only machines which have been approved by the Industrial Accident Commission shall be used.

(c) Putlogs may be of wood, provided they are equal in strength to four by four (4×4) inch straight-grained Oregon pine timber, free from knots that affect the strength of the wood.

(d) The putlogs and thrustouts shall be spaced not more than eight (8) feet center to center.

(e) The platform shall be not less than four (4) feet wide, and made of not less than two (2) inch planks laid tight and adequately secured to prevent them from slipping, tipping or collapsing.

(f) The outside of the platform shall be provided with a substantial railing of iron or wood, at least three feet six inches ($3'6''$) high, and provided with a toeboard at least six (6) inches high. The space between the toeboard and railing shall be filled in with wire netting of not more than one-half ($\frac{1}{2}$) inch mesh or canvas securely fastened tight at top and bottom.

(g) The scaffold shall be as close to the wall as possible to prevent material falling between scaffold and building wall.

(h) When work is being done above such suspended scaffolds, the workmen on such a scaffold shall be substantially protected from falling material by a covering made of not less than one (1) inch boards laid close.

Order 1130 Tuckpointers' suspended scaffolds used by stone masons, stone cutters and similar trades.

(a) All bales, stirrups and slings shall be made of a least five-eighths ($\frac{5}{8}$) inch steel cable, composed of six (6) strands of nineteen (19) wires each, or of solid round or square steel not less than three-quarters ($\frac{3}{4}$) an inch in diameter, forged or welded in one piece.

(b) Beneath the platform of the scaffold there shall be an additional safety cable securely fastened to the stirrup or bale, to hold the platform if the bolster should break.

(c) All putlogs and bolsters shall be not less than two (2) inches wide and four (4) inches deep of first quality, straightgrained seasoned Oregon pine or equal.

(d) An iron or steel bolt not less than six (6) inches long and three-quarters ($\frac{3}{4}$) of an inch in diameter shall be fastened through the putlog or bolster at right angles to same, not nearer than three (3) inches to the end and halfway between the upper and lower sides, to prevent bale or sling from slipping off the end of bolster.

(e) The platforms of all tuckpointers' suspended scaffolds shall be made of planks not less than one and one-half ($1\frac{1}{2}$) inches thick, and shall be at least twenty-four (24) inches wide, substantially secured to putlogs or bolsters to prevent same from slipping or collapsing. The falls, or hangers, shall not be more than fourteen (14) feet apart.

Order 1131. Suspended scaffolds other than tuckpointers' scaffolds used by house painters, sign painters, building washers and similar trades.

(a) All suspended swinging or hung scaffolds or stagings for structures under fifty (50) feet in height shall be made of planks at least fourteen (14) inches wide and one and one-half ($1\frac{1}{2}$) inches in thickness, and shall be straight, sound, free from cracks, shakes and knots, and of the required dimensions throughout and securely fastened to putlogs or bolsters.

(b) For structures over fifty (50) feet high, the platform shall be at least twenty (20) inches wide.

(c) All bales, stirrups and slings shall be made of standard three-eighths ($\frac{3}{8}$) inch galvanized wire cable, or of solid round or square steel not less than three-quarters ($\frac{3}{4}$) of an inch in diameter, forged or welded in one piece. Loops and stirrups for the use of bolsters shall be spliced. The supporting loop shall have a galvanized thimble fastened in place with an approved clip.

(d) An iron or steel bolt not less than six (6) inches long and three-quarters ($\frac{3}{4}$) of an inch in diameter shall be fastened through the putlog or bolster at right angles to same, not nearer than three (3) inches to the end and half-way between the upper and lower sides, to prevent bale or sling from slipping off the end of bolster.

(e) The scaffoldings or stagings shall be fastened so as to prevent them from swaying from the building or structure, and all parts of such scaffoldings or stagings shall be rigidly constructed and of sufficient strength to support all loads that may be placed thereupon.

(f) The spans between falls or hangers shall be not more than fourteen (14) feet when the platform consists of a plank one and one-half by fourteen ($1\frac{1}{2} \times 14$) inches or one and one-half by twenty ($1\frac{1}{2} \times 20$) inches. When the platform consists of a plank two by fourteen (2×14) inches to two by twenty (2×20) inches, the span between falls or hangers shall be not more than sixteen (16) feet. When the platform consists of a ladder as specified in the following table, and a three-quarter by fourteen ($\frac{3}{4} \times 14$) inch or a three-quarter by twenty ($\frac{3}{4} \times 20$) inch plank, the spans between falls or hangers shall be not more than eighteen (18) feet, and not more than two men shall be allowed to work between two hangers or falls.

(g) Swinging or stage ladders.

Length in feet	Cross section of rails in inches	Cross section of rungs in inches	
		Round	Oblong
Up to 16	$1\frac{3}{8} \times 2\frac{3}{4}$	1	$\frac{3}{4} \times 1\frac{3}{8}$
16 to 20	$1\frac{3}{8} \times 4\frac{1}{2}$	1	$\frac{3}{4} \times 1\frac{3}{8}$
20 to 24	$1\frac{3}{8} \times 5$, tapered to 4 at ends	1	$\frac{3}{4} \times 1\frac{3}{8}$

Swinging or stage ladders used for suspended scaffolds shall be reinforced with at least four (4) three-sixteenths ($\frac{3}{16}$) inch rods to prevent side rails from spreading.

(h) Safety lines of five-eighths ($\frac{5}{8}$) inch diameter manila rope hanging from the roof, securely tied thereto, shall be provided between each pair of hangers or falls.

(i) The hocks supporting the scaffolds or stagings shall be made of high grade tire steel, or its equivalent, free from flaws or other imperfections, and when formed to shape shall sustain a maximum load of sixteen hundred (1,600) pounds. They shall be anchored to the roof or fire wall so as to prevent them from slipping. Whenever they are secured to wood it shall be sound and free from cracks and shakes. If the wood is found to be defective a sound plank shall be secured to the roof, to which the hooks shall be anchored, and they shall be tied rigidly with five-eighths ($\frac{5}{8}$) inch diameter ropes to solid and substantial objects on the roof.

(j) All ropes supporting scaffolds shall have a factor of safety of at least six, and shall be inspected and tested before being used on each job to ascertain whether they are sound and free from flaws or contact with any solution containing acid.

(k) Wherever any solutions containing acids, caustics, or any solutions injurious to hemp rope fiber are to be used by painters or other trades to clean buildings or other structures, the hangers or falls shall be manila rope, three-quarter ($\frac{3}{4}$) inch diameter, and said hangers or falls shall be protected to a height of six (6) feet above platform, with acid proof material.

(l) Building washers, painters and other trades using solutions containing acids, caustics or any solution injurious to hemp rope fiber, shall have each life line equipped with steel rings or some similar device spaced six (6) feet on centers, and every workman shall be required to wear an approved safety belt which shall be attached to said rings and life lines.

(m) Wherever any washing solutions as provided in section (l) are being used, the free ends of the falls, hangers and life lines shall be protected from coming in contact with the washing solutions containing acids, caustics or any solution injurious to hemp rope fiber, and coiled in barrels or other suitable receptacles.

(n) All scaffolds or stagings suspended more than ten (10) feet from the ground or floor, shall have a safety rail of wood or other equally rigid material of sufficient strength to prevent workmen from falling, and said rail shall rise at least forty-two (42) inches above the floor or floors of such scaffoldings or stagings."

(S.O. 1.7.1926.)

Ohio

Interior Suspended Scaffolds

"Section 165. Interior suspended scaffolds shall be constructed to provide a factor of safety of not less than four (4). Guardrails shall be provided on the unprotected sides of such suspended scaffolds over ten (10) feet high.

Section 166. The structural parts of buildings or structures to which interior suspended scaffolds are to be attached shall be carefully inspected by the employer or his authorised agent, before such scaffolds are put in place, to determine whether such structural parts are of sufficient strength and are of proper construction to securely and substantially support such suspended scaffold loads.

Masons' Suspended Scaffolds

Section 167. The term 'masons' suspended scaffold' shall mean a platform suspended by steel wire ropes and operated by machines.

Section 168. Suspension cables shall conform to the requirements set forth in section 28¹ of this code.

Section 169. No scaffold machine except those approved by underwriters' laboratories or machines of equal standard and strength, shall be used with any suspended scaffold. Where scaffold machines are rented, all of the fixtures and appliances received in connection therewith shall be erected and used at all times when such scaffolds are in service. The moving parts of scaffold machines shall be carefully inspected before put in use or operation and not less than every thirty (30) days thereafter when in continuous use upon any building or structure.

Section 170. The parts of buildings or structures to which suspended scaffolds are to be attached shall be inspected carefully by the employer or his authorized representative, before such scaffolds are put in place, to determine whether such parts are of sufficient construction and strength to securely and substantially support the load to be imposed on the suspended scaffold.

Section 171. Thrustouts shall be equal in strength to six (6) inch steel I-beams, or in the case of the overhead type of machine, steel channel beams of sufficient strength shall be used, which project not less than one (1) foot beyond the outer edge of the suspended platform and shall be securely anchored and fastened to the framework of the building by means of U-bolts and anchor plates tightened by the use of jam or lock nuts, or where building conditions prevent, by other equally effective means. I-beam thrustouts shall be equipped with a stop-bolt rigidly fastened and of adequate size to prevent the shackle from slipping over the end of the beam. Channel beam thrustouts shall be parallel and secured to each other by a bolt not less than three-fourths ($\frac{3}{4}$) inch in diameter over which substantial spreaders shall be placed to keep the beams the necessary distance apart.

Section 172. Bearers shall be securely fastened to the scaffold fixtures and spaced according to the load and material table, section 157,² but shall not be spaced more than eight (8) feet apart.

Section 173. The platforms of such suspended scaffolds shall not be less than four (4) feet in width. Platform planks shall be laid so that their edges abut and shall fill the entire length of the bearer. Platform planks shall be not less than two by ten (2×10) inches in size and shall overlap the bearer not less than one (1) foot, but not more than two (2) feet at the ends of the scaffold.

¹ See under § 5 "Ropes and Chains".

² See under § 1 (c) "Scaffold Materials and Construction".

Section 174. Ropes or hooks shall be used and fastened to the platform of the scaffold and to the building in such a manner and at such intervals as to prevent the scaffold from swinging away from the building. Likewise fenders shall be provided to prevent the scaffold from swinging against the building.

Section 175. Guardrails, toeboards and overhead protection shall be provided on the outside of all masons' suspended scaffolds as specified in sections 239 to 245 ¹ inclusive and sections 254 and 255 ² of this code. The space between the toeboards and guardrails shall be filled with wire screen of not more than two (2) inch mesh or other material providing equivalent strength and protection."

Swinging Scaffolds

"Section 176. Swinging scaffolds shall be not less than twenty (20) inches wide unless space will not permit and shall be attached to stirrups, hangers, or supports at intervals not exceeding sixteen (16) feet.

Section 177. Stirrups, hangers or supports shall be substantially constructed and connected with not less than three-fourths ($\frac{3}{4}$) inch round or one and one-fourth ($1\frac{1}{4}$) inch by three-eighths ($\frac{3}{8}$) inch wrought iron or steel for the main support frames. The minimum height of all hangers from the bottom to shackle or eye, shall be thirty (30) inches. The guardrail support shall be not less than one and one-fourth by three-sixteenths ($1\frac{1}{4} \times \frac{3}{16}$) inch angles. Stirrups, hangers or supports shall be securely fastened to the stage or platform by U-bolts or other fastenings that will provide a factor of safety not less than the requirements of this code.

Ladder platform type

Section 178. Ladder platform swinging scaffolds shall be constructed in accordance with the requirements in the table following. Not more than two (2) men shall be permitted on this type at one time.

Length of ladder	Min. inside width	Rail cross section. Ends	Rail cross section. Middle	Rungs		Iron rods		Flooring
				No.	Dia-meter	No.	Dia-meter	
feet	inches	inches	inches		inches		inches	inches
16	20	$1\frac{7}{8} \times 2\frac{3}{4}$	$1\frac{7}{8} \times 3\frac{3}{4}$	11	$1\frac{1}{8}$	4	$\frac{5}{16}$	$\frac{1}{2} \times 3$
18	20	$1\frac{7}{8} \times 3$	$1\frac{7}{8} \times 4$	12	$1\frac{1}{8}$	4	$\frac{5}{16}$	$\frac{1}{2} \times 3$
20	20	$1\frac{7}{8} \times 3$	$1\frac{7}{8} \times 4\frac{1}{2}$	13	$1\frac{1}{8}$	4	$\frac{5}{16}$	$\frac{1}{2} \times 3$
24	20	$1\frac{7}{8} \times 3$	$1\frac{7}{8} \times 4\frac{3}{4}$	16	$1\frac{1}{8}$	5	$\frac{5}{16}$	$\frac{1}{2} \times 3$

NOTES

- (1) All sizes and dimensions are minimum.
- (2) Rail sides shall be of clear spruce or other material of equal strength.
- (3) Rungs shall be round and of straight grained white oak, ash or hickory and shall have a minimum diameter of seven-eighths ($\frac{7}{8}$) inch at mortised ends.
- (4) Iron rods shall pass through the sides and be riveted over washers at both ends.
- (5) Floors shall be of spruce or equivalent material with upper surface dressed. The strips shall be spaced not more than five-eighths ($\frac{5}{8}$) inch apart, except at rails where the space may be one (1) inch.
- (6) The ladder platform shall be attached to stirrups, hangers or supports of the grade and strength specified in sections 176 and 177.

Plank type

Section 179. Swinging scaffolds may be constructed of planks supported by stirrups or hangers spaced not to exceed sixteen (16) feet and of the size, grade and attachment as specified in sections 176 and 177. Where two or more planks are used they shall be tied together with cleats not less than

¹ See under § 1 (c) " Scaffold Materials and Construction ".

² See under § 6 (c) " Catch Scaffolds and Protective Roofs ".

1 × 6 inch in size, spaced at intervals of approximately four (4) feet and securely fastened to the under side of the planks. The platform planks shall extend not less than six (6) inches nor more than twelve (12) inches beyond the supporting stirrups or hangers. The span between hangers and the size of planks shall conform to the provisions for allowable loads and stresses given in tables, section 23,¹ and the requirements of section 157² of this code.

Beam type. — (May be used for setting stone up to and including four storeys.)

Section 180. (a) Swinging scaffolds may be constructed by use of two or more longitudinal beams not less in size than 2 × 6 inches, with cross braces not less than 2 × 6 inches in size set on edge, securely fastened through the longitudinal beams at intervals of not more than four (4) feet, and covered with wood flooring securely nailed to the beams. The longitudinal beams shall extend not less than six (6) inches nor more than twelve (12) inches beyond the supporting stirrups or hangers. The size, grade and attachment of stirrups or hangers shall be as provided in sections 176 and 177 and the construction of such scaffolds shall conform to fig. 2,¹ the allowable loads and stresses specified in sections 23,³ 27⁴ and 28⁴ and the requirements of section 157.² This type of swinging scaffold may be used for setting stone, up to and including four (4) storeys in height. Not more than two (2) men shall be permitted on this type of scaffold at one time and no stone or other material shall be placed or stored thereon.

(b) Overhead protection shall be provided as prescribed in sections 254, and 255.⁵ In lieu thereof all openings directly above any portion of the scaffold shall be boarded up or covered with wire screen, not less than No. 9 U.S. Standard Gauge and not greater than two (2) inch mesh, to a height of not less than three (3) feet six (6) inches. Such scaffolds shall not be tied together but the platforms thereof shall be so lashed or secured that they cannot sway from the structure.

Section 181. All cables, ropes, blocks, sheaves and pulleys used in connection with swinging scaffolds shall be securely fastened and shall conform to the requirements for allowable loads specified in sections 28 and 31.⁴ Inspection and tests shall be made in accordance with sections 27 and 29⁴ of this code.

Section 182. All blocks and tackle shall fit the size of rope they carry and shall be so constructed that they do not chafe or abrade the ropes running through them.

Section 183. Life lines of the strength prescribed in section 28⁴ shall be provided for each man on the scaffold and shall be securely fastened above the operation and extend a sufficient distance below to permit a safe landing. The free ends of falls, etc., shall be guarded to prevent interference with the scaffold equipment by vehicles or other moving objects.

Section 184. Wherever practicable, the platforms of swinging scaffolds shall be so lashed or secured while in use that they cannot sway from the structure.

Section 185. Two or more swinging scaffolds shall not, at any time, be combined into one by bridging the distance between them with planks or similar connecting links.

Section 186. The use of swinging scaffolds for setting stone is prohibited except as provided in sections 180 and 191.

Section 187. Where hooks are used to support swinging scaffolds they shall be of a strength equal to wrought iron or steel of a section not less than

¹ Not reproduced.

² See under § 1 (c) " Scaffold Materials and Construction ".

³ Specifications not reproduced.

⁴ See under § 5 " Ropes and Chains ".

⁵ See under § 5 " Catch Scaffolds and Protective Roofs ".

five-eighths by two ($\frac{5}{8} \times 2$) inches bent edgewise and provide a factor of safety not less than the requirements of this code. Hooks shall rest upon and be securely fastened to substantial parts of the building or structure.

Section 188. Thrustouts or outriggers used to support swinging scaffolds shall be substantially secured as provided in sections 195 and 196.¹

Section 189. Swinging scaffolds shall be equipped with a standard guardrail, intermediate rail and toeboard on the exposed side as specified in sections 239 to 245 ² inclusive of this code.

Section 190. One (1) inch hemp rope or cable of equal strength securely fastened may be used for intermediate rails on swinging scaffolds.

Special swinging scaffold

Section 191. (For setting stone above four storeys.)

Note: The use of manila rope, now in stock or on hand, for suspension of this type of swinging scaffold will be permitted for a period not to exceed two (2) years from and after the date on which this code becomes effective, *provided* such rope and the blocks, sheaves and pulleys used in connection therewith, shall be inspected and conform in all respects to the requirements of sections 26, 27, 28 and 31 ³ of this code. Any replacements that may be required and made, within the above limitation for use of manila rope, shall comply with the following specifications for this scaffold.

(a) Stone setters' swinging scaffolds for use in setting stone four (4) storeys and above in height shall be thirty (30) inches wide and shall not exceed twenty (20) feet in length. Such scaffold shall be constructed in accordance with the requirements of section 157 ⁴ and of materials conforming to the allowable loads and stresses prescribed in sections 22 ⁴ and 23 ⁵ of this code. Not more than four (4) employees shall be permitted to work or to be on such scaffold at one time, and no stone or other material shall be placed or stored thereon. All cables employed in connection with the use and operation of such scaffold shall conform to the requirements prescribed in section 28 ³ of this code.

(b) This type of swinging scaffold shall be suspended at four (4) points by wire cables and operated by scaffold machines as provided in sections 167 to 169. The cables shall be secured by shackles over the thrustout, with the cable end a spliced eye or thimble, a closed socket, bridge socket or similar effective means. A stop bolt shall be passed through the web of the thrustout to prevent the shackle slipping off the end. Where more than one (1) such scaffold is in use upon a structure in close proximity, lashing or tying of them together is prohibited. The platforms of such scaffolds shall be so lashed or secured that they cannot sway from the structure.

(c) Stone setters' swinging scaffold shall be constructed in accordance with the following specifications.

(1) Side rails, stringers or horizontal sides shall be of 2 × 6 inch timber, of spruce, yellow pine or other material of equal strength.

(2) Lateral braces or cross braces shall be of material as specified in paragraph one (1) above.

(3) Nine (9) lateral or cross braces of 2 × 4 inch lumber shall be used. Two (2) of these braces shall be laid flat, seven (7) feet from each end and one (1) approximately three (3) inches from each end, laid on edge and securely nailed through the side rails. The remaining five (5) braces shall rest upon angles securely lag screwed into the side rails, or through bolted. The angles shall be approximately 3 × 3 × $\frac{1}{4}$ inches by 15 inches in length. The back

¹ See under § 2 (c) "Outrigger Scaffolds".

² See under § 1 (c) "Scaffold Materials and Construction".

³ See under § 5 "Ropes and Chains".

⁴ See under § 5 (c) "Scaffold Materials and Construction".

⁵ Specifications not reproduced.

of the angle shall be cut out 1 $\frac{5}{8}$ inches in width to the base or bottom, permitting the 2 \times 4 inch braces to be inserted and nailed to the side rails.

(4) Each scaffold end shall have a four (4) inch channel of steel 7.25 pounds per foot and thirty (30) inches in length, securely fastened through the side rails by $\frac{3}{8}$ inch bolts, lock-washers and nuts. The channels shall be slotted to receive the scaffold machine hangers. Iron tie rods one-half ($\frac{1}{2}$) inch in size shall be provided under the braces, spaced seven (7) feet from each end, pass through the side rails and shall be riveted or secured with lock washer and nut.

(d) Thrustouts or outriggers shall be not less in size than four (4) inch 13.8 pounds steel H-beam and shall project more than 36 inches beyond the line of the outside wall, and shall be secured as provided in sections 195 and 196.¹

(e) A guardrail shall be provided on the outside of the scaffold approximately forty-two (42) inches in height above the platform floor. Angle iron standards for support of the guardrail shall be provided one at each end 2 \times 2 \times $\frac{3}{16}$ inches in size and secured by $\frac{1}{2}$ inch bolts through the side rails. Two intermediate supporting standards approximately three (3) feet in each direction from the center. The intervening space between the guardrail and platform shall be filled with wire screen not less than No. 9 U.S. Standard Gauge and not greater than two (2) inch mesh, securely fastened in place.

(f) Overhead protection shall be provided as prescribed in sections 254 and 255.² In lieu thereof, all openings directly above any portion of the scaffold shall be boarded up or covered with wire screen not less than No. 9 U.S. Standard Gauge and not greater than two (2) inch mesh to a height of not less than three (3) feet six (6) inches.

Boatswains' Chair

Section 232. Boatswains' chairs attached by means of a sling to a suspended rope used for painting, cleaning or other small operations shall be constructed and supported in such manner that the factor of safety shall be not less than the requirements provided in sections 23,⁴ 28³ and 29³ of this code.

Section 233. Such chair shall have a seat not less than two (2) feet long, one (1) foot wide, by one (1) inch thick. Cleats shall be provided at each end of seat and shall project not less than nine (9) inches in front and substantially secured to the seat. The chair shall be swung by ropes or cables conforming to the requirements of sections 27, 28 and 29,³ securely fastened to the seat. Manufacturers' standard chairs may be used provided they comply with the requirements of section 232.

Section 234. Boatswains' chairs may be supported by means of blocks and tackle securely fastened overhead or by means of suspension from a fixed overhead object. Where either of these methods are impracticable as in the case of a flagpole the rope may be secured to the pole by means of a suitable and safe hitch.

Section 235. Where the chair is secured by means of an overhead block, the free fall line shall pass through the chair and be securely fastened thereto or to the bottom block or supporting tackle.

Section 236. When the suspension rope is attached to a fixed overhead object or secured to a pole by means of a substantial hitch, stirrups or supports shall be provided upon which a workman may rest while shifting the position of the chair. The stirrups or supports shall be fastened independent of the

¹ See under § 2 (c) "Outrigger Scaffolds".

² See under § 6 (c) "Catch Scaffolds and Protective Roofs".

³ See under § 5 "Ropes and Chains".

⁴ Specifications not reproduced.

chair and shall be as substantially constructed and securely fastened as the chair itself.

Section 237. Where practicable, safety belts shall be provided for employees using boatswains' chairs and shall be securely fastened to the supporting tackle.

Section 238. Block and tackle usually attached permanently to the top of stacks, etc., shall never be used to support a workman."

(S.R. March 1931.)

Pennsylvania

"Rule 4. *Suspended scaffolds.* (a) None but approved scaffold machines shall be used in the erection and use of any scaffold. Where scaffold machines are rented, all of the fixtures and appliances received in connection therewith shall be erected and used at all times when such scaffolds are in service. The moving parts of scaffold machines shall be frequently inspected and shall be exposed to view at all times so that possible defects may be readily detected but such moving parts shall be railed off or otherwise guarded so as to protect workmen from coming into contact with same.

(b) Where cables are used they shall conform to the requirements set forth in Rule 21.¹ Where steel ribbons or suspension supports other than cables are used, they shall possess a factor of safety in strength of at least eight (8).

(c) Thrustouts shall consist of steel I-beams or, in the case of the overhand type of machine, steel channel beams, which project at least one (1) foot beyond the outer edge of the suspended platform, and shall be securely anchored and fastened to the steel frame work of the building by means of U-bolts and anchor plates tightened by the use of jam or lock nuts or, where building conditions prevent, by other approved equally effective means. I-beam thrustouts shall be equipped with a stop-bolt rigidly fastened and of adequate size to prevent the shackle from slipping over the edge of the beam. Channel beam thrustouts shall be parallel and secured to each other by a bolt at least three-fourths ($\frac{3}{4}$) inch in diameter over which thimbles of iron pipe shall be slipped to keep the beams the necessary distance apart.

(d) Putlogs shall be securely fastened to the scaffold fixtures and spaced not more than eight (8) feet apart.

(e) Platform planks shall be laid so that their edges abut and fit "tight". Planks shall be not less than ten (10) inches wide and two (2) inches thick. The platform planks shall overlap putlogs by at least one (1) foot, but no more than two (2) feet at the ends of the scaffold.

(f) Ropes or hooks shall be used and fastened to the platform of the scaffold and to the building in such a manner and at such intervals as to prevent the scaffold from swinging away from the building. Likewise, fenders shall be provided to prevent the scaffold from swinging against the building.

(g) Protection shall be provided as set forth in Rule 23.²

Rule 5. *Painters' swinging scaffolds.*

(a) The platform planks shall be laid together and shall overlap the stirrup or hanger by at least twelve (12) inches. A bar, strip or other device shall be permanently attached to the platform outside the hanger to prevent the platform from slipping off the hanger.

(b) The iron stirrups or hangers shall be of a strength at least equal to wrought iron or steel three-fourths ($\frac{3}{4}$) inch in diameter and shall be so formed that guard rails may easily be secured to them. The distance between hangers shall not exceed fourteen (14) feet.

¹ See under § 5 "Ropes and Chains".

² See under § 6 (c) "Catch Scaffolds and Protective Roofs" and § 8 (c) "Protection of the Public".

(c) The hooks used to support the scaffold shall be of a strength at least equal to wrought iron or steel of a cross section five-eighths ($\frac{5}{8}$) inch by two (2) inches. They shall be securely anchored and supported. Care shall be taken that the eaves or cornices of a building are of assured soundness. Hooks, cornice irons, outlookers or other devices for fastening to the building shall be securely fastened to the eaves, cornices or other equally reliable object of support, and shall be frequently inspected. Hooks shall be tied so that they cannot slip off the cornices or eaves.

(d) Swinging scaffolds shall be constructed to bear at least four ($\frac{4}{1}$) times the maximum weight to be placed thereon. Every time the scaffold is erected it shall be tested by raising the platform about one (1) foot from the ground and loading it with at least four ($\frac{4}{1}$) times the maximum weight that will be imposed upon it.

(e) Blocks and ropes shall conform to the requirements set forth in Rule 21,¹ and ropes shall be double lashed at each point of suspension.

(f) Not more than two men shall be permitted on this type of scaffold at one time except where more than two stirrups with corresponding hooks, blocks and ropes are used, in which case one additional man may be permitted for each additional stirrup.

(g) Two or more swinging scaffolds shall not, at any time, be combined into one by bridging the distance between them with planks or similar connecting links.

(h) When leaving a swinging scaffold the men shall lash it securely to the building. Buckets or other loose objects shall be removed from such scaffold immediately upon the cessation of work by the men.

(i) Ropes or hooks shall be used and fastened to the platforms of the scaffold and to the building in such a manner and at such intervals as to prevent the scaffold from swinging away from the building. Likewise, fenders shall be provided to prevent the scaffold from swinging against the building.

Rule 16. Boatswain's chairs. (a) Boatswain's chairs or seats, attached by means of a sling to a suspended rope, used for painting, cleaning or other small operations, shall be constructed and erected with the greatest possible care. Boatswain's chairs shall have a seat of at least ten by eighteen (10 × 18) inches.

(b) The suspended rope shall either be securely fastened to a fixed object above the operation or passed through an overhead block, the free end being securely fastened to some fixed and easily accessible object, except where either of these methods of construction are impossible, as in the case of a flag pole, when the rope may be secured to the pole by means of suitable and safe hitch.

(c) Stirrups shall be fastened independent of the chair. When the stirrup is connected to a hook from a block or pennant, the fastenings shall be securely lashed or seized to such hook by marlin or good rope yarn. The same care shall be exercised in supporting the stirrups as in fastening the chair.

(d) Safety belts shall be worn by men occupying boatwain's chairs, such belts being fastened securely to the supporting tackle and so arranged that the workman cannot slip out of the seat.

(e) All ropes used shall conform to the requirements set forth in Rule 21.¹

Rule 1

(n) The moving parts of scaffolding machines shall be regularly inspected twice a month by the employer of the men using the machine and a record kept of the findings of the inspections. This record shall be accessible to representatives of the Department at all times.

¹ See under § 5 "Ropes and Chains".

The owner of the scaffolding machine shall be notified at once to replace any defective or worn parts and the use of the machines shall be discontinued until such replacements have been made. In addition the owner or lessor shall make a monthly inspection and keep a record of the findings. This record shall also be accessible to representatives of the Department.

When a scaffolding machine is removed from a location it shall be thoroughly inspected and overhauled before again being used."

(R. 1933.)

Wisconsin

"Order 3518. *Swinging and suspended scaffolds.* All mechanism and parts of the suspension system of any suspended scaffold shall be of a type and design approved by the Industrial Commission.

Note: To secure such approval, plans and specifications for the complete suspension system, including details of operating mechanism, should be submitted to the Industrial Commission.

Wire rope which conforms to the requirements of Order 3532 ¹ shall be used to support all suspended scaffolds. Wire rope or manila rope which conform to the requirements of Order 3532 ¹ shall be used to support all swinging scaffolds.

Suspended scaffolds shall be supported by the structural framework of a permanent structure, or from beams anchored to the permanent structure, except that such beams resting on the structurally completed roof of a building may be held in place by weighting if the weighting is done on a stable platform resting on the beams and the weighting force is equal to not less than three times the overturning force due to the maximum suspended load. The beams supporting a suspended scaffold shall be steel I-beams, or double steel channels bolted or riveted together. Spacers, where required in connection with double channel beams, shall be of metal.

Swinging scaffolds shall be supported in the manner required for suspended scaffolds, or may be supported by the completed wall of a structure by means of forged iron or steel hooks, or similar devices, with bearing so arranged as to distribute the load at each anchorage uniformly along a horizontal section of the wall.

Note: Hooks supporting swinging scaffolds as above should be tied back to some anchorage on the building wherever possible.

Where more than one swinging scaffold is used on any job, there shall be no connection between such scaffolds unless the individual scaffolds are arranged so that they cannot be moved while the connecting platforms are in place.

A life line, with fixed end fastened independent of the scaffold and with free end extending to the ground, shall be provided for each workman on a swinging scaffold. Where the nature of the work permits, each workman on a swinging scaffold shall secure himself with a life line, such as passing the life line through a loop or ring in a safety belt worn by him.

Recommendation. It is recommended that life lines be provided in connection with suspended scaffolds wherever possible."

(G.O. 15.7.1933.)

FINLAND

"Suspended scaffolding, where the staging is suspended by means of ropes, shall be hung so that the ropes are not liable to be frayed against sharp edges. The ropes shall be fastened directly to rafters, fixed joists or other firm parts of the framework of the building. The ropes shall not be fastened to hooks which are screwed or hammered in."

(Res. 15.11.1927, sec. 24.) .

¹ See under § 5 "Ropes and Chains".

FRANCE

"39. Movable or suspended scaffolding of all kinds, even when erected on a workplace for a short time only, shall comply with the following requirements.

It shall not exceed 8 m. in length.

The platform shall be close planked and there shall be a toe-board 15 cm. high on the outer side and at both ends.

It shall be fitted with guard-rails consisting of a rigid cross piece fixed at a height of at least 70 cm. on the side towards the wall, and 90 cm. on the other three sides. These guard-rails shall be carried on uprights solidly fixed to the platform at intervals of not more than 1.50 m. The platform and the guard-rails shall be formed into a rigid whole before being suspended, by firmly fixing the guard-rails and toe-board to the stirrups.

40. When movable or suspended scaffolds are slung by ropes, these shall be not less than three in number, placed at intervals of not more than 3 m. and adjusted to the iron stirrups surrounding and supporting the rigid framework of the scaffold. The ropes shall be manipulated by a block or similar mechanism and be hung from or fastened to firm parts of the structure, every care being taken to avoid the risk of jolting.

Two ropes shall be deemed sufficient for suspending movable or suspended scaffolds not exceeding 3 m. in length.

41. For minor roofing, plumbing, stove or chimney work or painting operations, for which no suspended scaffolding is erected, the use of knotted ropes, suspended ladders or platforms slung by means of ropes shall be permitted, provided that the said ladders or ropes are attached to a solid part of the structure and that the work does not involve the use of any corrosive substances, such as lye or hydrochloric acid (spirits of salt)."

(D. 9.8.1925/26.11.1934.)

GREAT BRITAIN

"26. No suspended scaffold shall be used unless it complies with the following requirements:

(a) The platform shall be at least 17 in. wide and of adequate strength.

(b) The means of suspension shall be of adequate strength and firmly secured. If a weight is used for the purpose of suspension, this weight shall be adequate having regard to all the circumstances of the case.

(c) The scaffold shall be provided with a suitable guard-rail and toe-board, or other efficient means to prevent the fall of persons or articles from the platform.

Trestles or other means of increasing the height of the working platform shall not be used on suspended scaffolds.

When a skip or large basket is used as a suspended scaffold for one man, it shall not be less than 2 ft. 6 in. deep and shall be carried by two strong iron bands properly fastened and continued round sides and bottom, with eyes in the iron to receive the ropes."

(R. 21.6.1926.)

IRISH FREE STATE

As for *Great Britain*.

ITALY

"6. Ladders, and suspended and flying stages, shall be constructed and secured regularly and solidly having regard to the weight that they have to bear. The platforms of suspended and flying stages shall be protected by a handrail or guard as in section 4.¹ Every other equivalent device shall be firmly fixed and similarly protected.

¹ See under § 4 (c) "Working Platforms".

The handrails and guards may only be omitted when the workers are protected by a life line fastened round their chest.

Suspended stages and other similar appliances for the construction and repair of electrical conductors at dangerous voltages shall be provided with suitable insulating devices."

(R.D. 27.5.1900.)

LUXEMBURG

"11. Flying, hanging and ladder scaffolding shall not be used except for light work such as roofing, plumbing, plastering, painting or repairing which does not require the use of heavy loads of materials.

Flying scaffolding shall be firmly secured to the inside of the building.

For the suspension of hanging scaffolding sufficiently strong and securely fastened ropes shall be used.

All such scaffolding shall be provided with guard-rails.

In the case of scaffolding on which the employees work sitting, the guard-rails shall consist of two laths, one at a height of 40 cm. and the other at a height of about 1 m."

(O. 28.8.1924.)

MEXICO

As for *Spain*, except for slight differences of detail.

NEW ZEALAND

"No person shall use any swinging-stage in connection with building work until a certificate in the prescribed form authorizing the use of such stage has been issued by an inspector."

(A. 31.10.1922. sec. 7.)

POLAND

"21. (1) Suspended scaffolds shall be used only for work that needs small quantities of materials.

(2) The outriggers from which suspended scaffolds are hung shall be suitably anchored to the ceilings or the roof structure, and secured against displacement and tipping. The part of the outrigger inside the building shall be at least twice as long as the part outside. The fastening of outriggers by housing alone shall be prohibited. Outriggers shall be in iron with a double-T cross section, or in squared timber with a cross section of at least 0.14×0.16 m., or in round timber at least 0.15 m. in diameter. Outriggers shall not be spaced more than 2.50 m. apart.

(3) To attach the platforms to the outriggers use shall be made of pulley blocks suitably fastened, sufficiently strong and provided with appropriate wire or hemp ropes.

(4) For the suspension of the platforms it shall be prohibited to use hemp ropes with a diameter of less than 38 mm. Ropes shall be perfectly sound; those in which a single strand is damaged shall not be used.

(5) The rope hooks shall be fastened to the deck irons in such a way that the ropes cannot come out of the irons. The fastening of the ropes to the hooks and deck irons shall be secure; it shall be effected by splicing the free ends of the rope, for example, and not by tying them with cord.

(6) The scaffold platforms shall as far as possible be horizontal. They shall be close-planked, and their sides shall be protected by a guard rail or a net. The width of the platforms shall not be less than 50 cm.

(7) It shall be prohibited to join two suspended scaffolds by means of a gangway or to use trestles or ladders on such scaffolds.

(8) The scaffolds shall be secured against swinging.

(9) To suspend the scaffolds use shall be made of ordinary suspension hooks, bent hot and designed to hold the anticipated load.

(10) Workers employed in the erection and dismantling of the scaffolds shall be protected by means of a rope, except when this is impossible by reason of local conditions.

(11) During interruptions of any length of time in the work, at night for example, suspended scaffolds shall be fastened at a height of over 2 m.; and all the ropes and ladders shall be raised if the workplace is open to the public.

(12) The strength of the scaffolds shall be tested before every occasion of use.

(13) Only skilled workers who are perfectly familiar with the work and with the use of such scaffolds shall be employed on suspended scaffolds. At least four men shall be employed to move the scaffold, two being reckoned for the handling of each of the ropes."

(D.23.5.1935.)

SWITZERLAND

Geneva

"34. When fixed or suspended scaffolds are carried by outriggers, the outriggers shall have a large cross section if of wood, and a thick section if of iron. The inside ends of such outriggers shall be solidly anchored. Only firm parts of the building shall be used as supports for outriggers.

Outriggers shall be braced and firmly wedged so as to prevent any side displacement.

To guard against vertical rocking movements, wherever possible stout props shall be placed on them and wedged under the ceiling joists or ribs. When this is not possible, the materials used as counterpoise shall not rest directly on the outriggers but on a flooring, so as to ensure their stability. Such counterpoise shall be calculated so as to afford an eightfold margin of safety, and shall be examined daily, before work is resumed, by those in charge of the building.

35. Working with knotted ropes, suspended ladders, or platforms attached to ropes, shall be formally prohibited for all classes of workers. Only hoisting platforms with sides shall be allowed.

55. The use of suspended scaffolds shall be authorised for roughcasting, painting, etc., on façades.

56. Suspended scaffolds shall be formally prohibited in front of balconies over 4 m. in length and bay windows unless the latter are continuous over the full height of the building. The operation of pulley blocks in front of balconies shall not be authorised until the workers have left the platform. The distance between the sets of ropes shall be greater than the length of the balconies.

57. Suspended scaffolds shall be hung by means of two or three sets of ropes, not more than 4 m. apart, and iron stirrup straps. The latter shall enclose the rigid cage of the scaffold that they support. When three sets of ropes are used, the centre set shall be slacker than the other two. Suspended scaffolds shall be moved by means of pulley blocks or similar appliances.

The stirrup straps shall be provided with vertical iron supports for fastening the guard rails.

58. The scaffold itself shall consist of two ledgers of adequate cross section carrying the flooring by means of solid cross pieces not more than 1 m. apart. The flooring shall be formed of planks closely laid and 40 mm. thick. All these parts shall be assembled so as to be completely solid one with another.

59. The parts of suspended scaffolds overhanging beyond the pulley blocks shall not exceed 80 cm.

60. Suspended scaffolds shall be provided with guard-rails on all four sides. The guard-rails shall be 90 cm. high on the three open sides and 70 cm.

high on the façade side. They shall consist of two rails having a cross section of at least 24 sq. cm. (deals 3×8 cm., or their equivalent) and a guard-plank or toe-board 15 cm. high.

The rails shall be firmly fastened to uprights having the same cross section and placed not more than 1 m. apart.

All wood containing bad knots shall be discarded.

61. Before being suspended, the entire system of ledgers, flooring and guard-rails forming the cage of the suspended scaffold shall be assembled in such a way as to form a perfectly rigid whole.

62. All parts of suspended scaffolds (blocks, pulleys, winches, stirrup straps, cages, etc.) shall be of types approved by the Department of Public Works.

63. When it is indispensable to use a gangway to connect two suspended scaffolds, the gangway shall be firmly fastened to each and provided with guard-rails and toe-boards, as specified in section 60 above.

The use of loose planks shall be formally prohibited.

64. The outriggers or needles of suspended scaffolds shall comply with the provisions of section 34.

65. Pulleys and ropes of suspended scaffolds shall be fixed to the outriggers before the latter are put into an overhanging position. The lashing fixing the pulley to the outrigger shall be protected against bad weather.

66. The suspension ropes of suspended scaffolds shall so hang that the gap between the flooring of the scaffold and the bare façade shall not exceed 20 cm.

67. For work requiring pressure on the wall such as might displace or rock the scaffold, suspended scaffolds shall be securely lashed to the façade.

Such lashing shall be remade immediately after every movement of the scaffold.

In order to allow of lashing on party walls and walls without bays, such walls shall be provided with a sufficient number of rings permanently fixed.

68. Every evening at the close of work all suspended scaffolds shall be lashed over 2 m. above the ground, and the ropes and ladders shall be withdrawn if the absence of a hoarding makes it possible for unauthorised persons to approach.

69. Work on suspended scaffolds shall be entrusted only to skilled men conversant with the handling and use of this type of scaffolding. Raising and lowering shall always be done by at least two men on each set of ropes.

70. All permanent loads other than cases and mortar buckets shall be prohibited on suspended scaffolds."

(R. 25.3.1930.)

Zurich

" 29. Flying, hanging and rope scaffolds shall only be employed subject to special authorisation, and only after inspection by the scaffolding inspectorate.

Flying scaffolds shall be anchored inside the building and provided on the outside with a guard wall at least 90 cm. high. Rope scaffolds shall be laid in pulleys of adequate thickness. The hook bearers of suspended scaffolds shall be bent round. The scaffolds shall be provided with guard-rails.

30. Suspended and outrigger scaffolds shall be erected on sound technical principles, shall be suited to the circumstances of each individual case, and shall be so maintained that the work can be done without any risk whatsoever.

The scaffolds shall always be loaded as evenly as possible and only to the extent that their bearing capacity allows."

(R. 31.1.1931.)

CZECHOSLOVAKIA

" 33. (1) Suspended scaffolds shall be permitted only for minor repairs on existing buildings, e.g. for repairing plaster work, for painting and lime-

washing. Such scaffolds shall always be suspended from sufficiently strong and securely anchored outrigger beams by means of perfectly sound ropes tested before use.

(2) The supporting ropes shall be fastened to cantilever supports (needles) in such a way that the suspension gear cannot slip off or be displaced. In the case of suspended erectors' scaffolds, chains or rigid iron rods of sufficient strength may be used instead of ropes.

(3) The maximum number of persons allowed on a suspended scaffold, its other maximum loads and the minimum strength of the supporting ropes shall be permanently and suitably marked on the suspended platform.

34. (1) In default of self-locking mechanism preventing the sudden or unintended slipping of the scaffold, all mechanical hoisting apparatus for suspended scaffolds shall be provided with a ratchet wheel, pawl and brake. All toothed gear shall be covered by a hood.

(2) The suspended scaffold shall be suitably secured against swinging, and provided on the outer sides with a firm guard-rail with at least two horizontal bars or with lattice-work fencing. The suspension hooks of suspended scaffolds shall be provided with a catch to prevent the rope from slipping out, etc.

(3) Suspended platforms shall not be lengthened. Further, they shall not be used as supports for other scaffolds."

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

"81. In order to ensure adequate rigidity, suspended scaffolds shall be fitted with cross bracing and strengthened, where necessary, by struts. . . .

90. Suspended scaffolding shall be tested as to its resistance and stability with due regard to the maximum weight of men and materials it will have to support.

139. When hanging platforms are used for working purposes, the ropes shall be attached to pulley-blocks securely fixed to some part of the building that is strong enough to bear the platform and its maximum load; the safety factor of the platform shall be determined with reference to its maximum load.

The ropes (cables) shall be attached in a perfectly secure manner to the hanging platform and to the winch.

The construction of the platform shall be such that there is no risk of persons or objects falling from it.

When the hanging platform is supported by hooks, the hooks shall be fitted with some device to prevent the ropes from slipping.

140. A person working on a hanging platform shall not move it up or down himself unless the platform possesses its own mechanism for so moving and provided that there is no risk of the platform falling if the worker's hands are removed from the said mechanism while the platform is being raised. The ropes from which such platforms are suspended shall be of steel.

If the conditions in the preceding paragraph are not fulfilled, no person working on a hanging platform shall move it upwards or downwards; in this case lowering and raising shall be performed by means of a winch and by some person not on the platform.

Workers shall not be hoisted on a piece of wood attached to a rope."

(O 5.5.1930.)

URUGUAY

". . . Flying scaffolds shall be loaded as lightly as possible, shall be securely anchored to the building, and shall have a guard board at least 0.40 m. high."

(D. 14.4.1915, sec. XII.)

YUGOSLAVIA

" 118. Suspended scaffolds shall be attached only to a main joist of sufficient strength; they shall be supported by strong ropes, wires or chains.

The maximum number of workers that may be employed on a suspended scaffold shall be indicated on a conspicuous notice on the scaffold.

When the scaffold is lowered by a winch, the winch shall be fitted with a reliable brake of adequate strength and also with an emergency brake.

Appropriate measures shall be taken to secure all suspended scaffolds against swinging."

(R. 25.10.1921.)

(f) BRACKET SCAFFOLDS

GERMANY

See under § 8 (a) "Special Regulations for Factory Chimney".

AUSTRALIA

New South Wales

" 9. Wood brackets, strapped with iron at angles, or iron brackets, approved by the inspector, may be used for painters, plasterers, tuckpointers, carpenters, and plumbers.

The manner in which brackets are fixed in position will be to the inspector's approval.

No brackets depending upon a wall solely for support will be allowed to be fixed to green brickwork or hollow walls."

(A. 26.11.1912, Second Schedule, sec.9.)

Queensland

" 18. No wooden brackets shall be used for or in connection with any scaffolding the method of construction of which is prescribed by these Regulations."

(R. 25.2.1916.)

Western Australia

As for *Queensland*.

UNITED STATES

Ohio

Carpenters' Bracket Scaffolds

" Section 217. Carpenters' portable bracket scaffolds shall be constructed and erected in conformity with the unit stresses and allowable loads as given in tables, sections 23¹ and 157² of this code.

Section 218. The minimum width of platforms on carpenters' bracket scaffolds shall be not less than two (2) ten (10) inch planks, laid in compliance with section 145.³

Section 219. All brackets shall be built to carry safely at the outermost edge a load of two times the total weight to be placed upon it, but not less than four hundred (400) pounds. Where bolts are used for fastening brackets to the building they shall be not less than five-eighths ($\frac{5}{8}$) inch in diameter.

¹ Not reproduced.

² See under § 1 (c) "Scaffold Materials and Construction".

³ See under § 4 (b) "Gangways, Runs, etc.".

Section 220. Brackets shall be securely anchored to the studding and not to the sheeting and they shall be securely braced against spreading or turning. Brackets shall be spaced not more than ten (10) feet center to center.

Section 221. Carpenters' bracket scaffolds, ten (10) feet or more above the ground or other level, shall be guarded in accordance with sections 239 to 245 ¹ inclusive.

Section 222. The use of scaffold brackets hung on nails or secured to sheeting boards only, is prohibited, except that brackets hung on nails not less in size than twenty penny and not less in number than four to each bracket, driven into the studs, may be used in repair work and when applying tongued and grooved siding.

Ladder Jack Scaffolds

Section 223. Ladder jack scaffolds shall be constructed with a factor of safety of not less than two (2) and conform generally to the provisions and specifications for ladders and secured against slipping, tilting or tipping as provided in section 275. ²

Section 224. Ladder rungs shall not be used to support more than one (1) section of plank and not more than two employees shall be permitted to work upon such section of planking at the same time. Where it is necessary to lap planks they shall be supported by ladder jacks attached to both side rails of the ladder and not to the rungs. Employees shall inspect ladders, and particularly the rungs thereof, before using the jacks upon them.

Section 225. No ladder jack shall be used with triple extension ladders.

Section 226. Platform planks shall be not less than two by ten (2 × 10) inches in size, of select structural grade as defined by the Manual of Standard Wood Construction, Southern Pine Association, 11th Edition, overlap the outer bearing surface not less than eight (8) inches and shall have a span of not more than twelve (12) feet. Telescope extension planks are prohibited.

Window Jack Scaffolds

Section 227. Window jack scaffolds shall be used only for the purpose of working at the window through which the jack is placed. The placing of planks between one window jack and a jack in an adjacent window is prohibited. Window jacks shall not be used as the supporting elements for other scaffolds.

Section 228. "Not more than one person shall be permitted to be on a window jack scaffold at any one time."

(S.R. March 1931.)

Pennsylvania

"Rule 6. Carpenters' bracket scaffolds: (a) Platform boards shall be laid tightly together and shall overlap the brackets by at least four (4) inches but not more than six (6) inches. The boards shall be heavy enough to prevent springiness of the platform.

(b) Brackets shall be spaced at intervals not greater than four (4) feet. There shall be at least three brackets underneath each board. In the erection of the brackets provision shall be made for the placement of guard-rails and toe-boards.

(c) The brackets shall have their supporting bolts near the top and such bolts shall be securely anchored and fastened. The practice of merely passing the bolt through the sheathing is prohibited and some additional means of anchorage shall be improvised, dependent upon the type of building. The

¹ See under § 1 (c) "Scaffold Materials and Construction".

² See under § 4 (a) "Ladders".

bolt shall be at least three-fourths ($\frac{3}{4}$) inch in diameter and shall be long enough to project at least one (1) inch beyond the nut when in place.

(d) Protection shall be afforded as required in Rule 23.¹

Rule 12. Ladder jack scaffolds: (a) Platform planks shall be at least two (2) inches in thickness and ten (10) inches in width and shall extend over the full bearing surface of the ladder jack. Platform planks shall overlap the bearing surface by at least four (4) inches, but not more than six (6) inches. Platform planks shall not have a span of more than ten (10) feet unless provided with a truss in the center when the span shall not exceed fifteen (15) feet.

(b) No ladder jack shall be used at a height greater than twenty-two (22) feet above the ground or working level, and in no case shall ladder jacks be used with extension ladders.

(c) Not more than one (1) person shall be allowed on a ladder jack scaffold at any one time unless the platform plank is trussed in the center.

(d) All ladder jacks shall be of approved type. The ladder jack shall be clamped or otherwise securely fastened to the ladder and shall bear on the side rails.

(e) All ladders used in conjunction with ladder jacks shall be designed, constructed and maintained according to the requirements of the Regulations for Ladders.

(f) All ladders used in conjunction with ladder jacks shall be equipped with approved devices or shall be so placed, fastened or held as to prevent slipping.

Rule 13. Window jack scaffolds: (a) Window jack scaffolds shall be used only for the purpose of working at the window through which the jack is placed. The placing of planks between one window jack and a jack in an adjacent window is prohibited. Window jacks shall not act as the supporting elements for other scaffolding.

(b) Not more than one (1) person shall be permitted to be on a window jack scaffold at any one time.

(c) Window jacks shall be of an approved type."

(R. 1933.)

Wisconsin

"*Order 3517. Bracket scaffolds.* Brackets used to support scaffold platforms shall be designed and built, and anchored to a structure when in use, to carry safely, in accordance with the provisions of Order 3513,² the load to be sustained in use, but not less than 200 lbs. at the outer edge. Wood scaffold platforms supported by brackets shall be made of planks not less than nominal 2 × 10 in. in sectional dimensions.

In frame buildings, scaffold brackets shall be supported by the framework, except that scaffold brackets may be supported by the sheathing under the following conditions:

1. The bracket hook or other anchor shall be designed to enter the sheathing at the lower edge of a board, shall distribute the pull and pressure due to the bracket load over the full width of that board, and shall apply the weight of the bracket load to the board below the hook entrance opening.

2. The bracket hook (anchor) shall enter the sheathing adjacent to a member of the framework to which the supporting boards are attached.

3. The nails which fasten the upper sheathing board to the framework shall be plainly visible at all times while the scaffold is used.

4. No joint in the sheathing boards that support a scaffold bracket shall be less than 2 feet from the bracket hook opening.

¹ See under § 6 (c) "Catch Scaffolds and Protective Roofs: § 8 (c) Protection of the Public".

² See under § 1 (c) "Scaffold Materials and Construction".

Bolts, bars, straps and similar steel or iron anchors used to fasten scaffold brackets to structures shall be not less than $\frac{5}{8}$ in. in diameter, or equivalent. All scaffold brackets shall be secured to prevent turning or slipping and shall be arranged to prevent spreading."

(G.O. 15.7.1933.)

GREAT BRITAIN

"No figure or bracket scaffold supported or held by dogs or spikes driven into the wall shall be used."

(R. 21.6.1926, sec. 27.)

IRISH FREE STATE

As for *Great Britain*.

(g) TRESTLES AND TRESTLE SCAFFOLDS; FRAME OR SQUARE SCAFFOLDS; FOOT SCAFFOLDS.

GERMANY

"55. (1) For trestle scaffolds only properly constructed scaffold trestles shall be used.

(2) Not more than two trestle scaffolds shall be placed one above the other. Trestles erected one above the other shall be allowed only to a height of 4 m., and shall be braced.

(3) Trestle scaffolds shall stand only on completely close-planked flooring, never directly on open framework or on ceiling boards. A sufficiently strong base shall also be provided for trestles resting on the ground.

(4) Barrels, cases, pails, piled bricks, etc., shall not be used to support scaffolds."

(R. 1.1.1930.)

AUSTRALIA

New South Wales

"Where . . . trestle scaffolding is erected from open floor joists or girders, the joists and girders must be temporarily close covered for a width of at least 5 ft. from the outside edge of scaffolding.

Trestles where used shall have the legs spread all ways, and all trestles or slipheads shall be properly framed together."

(A. 26.11.1912, Second Schedule, sec. 20.)

Queensland

"(vii) Such trestles as may be approved by an inspector may be used in place of standards. The standards may only be omitted when the internal or division walls form sufficient bearing for ledgers. The distance between any two such bearings shall not exceed 8 ft."

(R. 25.2.1916, sec. 16.)

Western Australia

As for *Queensland*.

AUSTRIA

"10. Trestle scaffolds without longitudinal bracing shall not be allowed; such bracing shall at least be ensured by stays, suspended by clamps.

If the trestles are placed on the ground care shall be taken to provide a sufficiently firm base; if on scaffolds the trestles shall never rest on open planking, but always on closely laid and sufficiently strong boarding.

In the case of trestle scaffolds 1.9 m. or more in height, and of two trestle scaffolds placed one on the other, the boarding shall be enclosed by toe-boards, and in addition guard-rails shall be affixed."

(O. 7.2.1907.)

UNITED STATES

California

"Order 1127. (a) All horse scaffolds shall not be more than sixteen (16) feet in height. All horse scaffolds shall be substantially constructed of sound lumber and braced internally and externally and the platform laid tight and adequately secured to prevent it from slipping, tipping or collapsing.

(b) All horses used for scaffolds shall be kept in good repair.

(c) The platform shall not be less than one and three-fourths ($1\frac{3}{4}$) inches in thickness and the distance between supports shall not exceed eight (8) feet. There shall be no openings in platforms excepting those necessary for passage of workmen and material.

(d) All platforms shall be at least four (4) feet in width.

(e) Any platform of a horse scaffold ten (10) feet or over in height shall be provided on the outside edge with a toeboard not less than six (6) inches in height above the top of platform.

(f) Horses for scaffolds shall be constructed as follows:

	Minimum dimensions in inches
Bearers or header	2 × 4
Legs	2 × 3
Gross braces	2 × 3 or 1 × 8
Diagonal braces	2 × 3

(g) Materials of different sectional dimensions may be used if of strength equal to that given. All braces except the one immediately under the header must be bolted securely with three-eighths ($\frac{3}{8}$) inch bolts."

(S.O. 1.7.1926.).

Ohio

Horse or Frame Scaffolds

"Section 199. All horses and frames shall be constructed in conformity to the allowable loads and stresses prescribed in sections 23¹ and 157², not to exceed sixteen (16) feet in height, and maintained in good condition. Horses or frames with members that are broken or split shall be repaired or removed from service. The practice of nailing extension legs on horses to increase their height or extensions nailed on bearers to increase their width is prohibited.

Section 200. Masons' horse scaffolds shall be not less than four (4) feet wide. Platform boards shall be not less than two (2) inches in thickness by ten (10) inches wide and shall overlap the frames or horses not less than four (4) inches.

Section 201. All horse or frame scaffolds shall be set level on substantial foundations. When built more than one (1) tier high, the horses shall be set in vertical lines, separated at each tier with a continuous two (2) inch plank placed under the vertical members thereof with cleats nailed to planks

¹ Not reproduced.

² See under § 1 (c) "Scaffold Materials and Construction".

to prevent the end horse slipping off supports and with all parts of the scaffold securely braced to give rigidity to and to prevent excessive swaying of such scaffolds.

Section 202 (a) Horses for stone-masons' scaffolds shall be constructed as follows:

	Dimensions in inches
Bearers	3 × 4
Legs	1 1/4 × 4 1/4
Braces	1 1/4 × 6
Half diagonal braces	1 1/4 × 3

Notes: (1) The distance between horses shall be not more than eight (8) feet and shall not be built over three (3) tiers or horses high.

(2) Distance between legs at bottom shall be not less than two-fifths (2/5) nor more than three-fifths (3/5) the height of the horse.

(b) Squares or frames used to support masons' scaffold planks shall be securely fastened on both sides at the corners with not less than one (1) by four (4) inch braces and shall have braces on both sides running diagonally from the center of each side to the center of adjacent sides. The frames shall have lateral diagonal bracing not less than one (1) by eight (8) inches in size on both the front and rear members of scaffold. They shall be constructed as follows:

	Dimensions in inches
Bearers	2 × 4
Legs	2 × 4
Braces at corners	1 × 4
Braces — Diagonal from center of frame	1 × 8

Note: The distance between frames shall be not over eight (8) feet and shall not be built more than three (3) tiers or frames high unless properly anchored and equivalent strength and rigidity provided.

(c) Hinged frames used as horses to support masons' scaffolds shall be constructed similar to squares or frames with diagonal bracing. They shall be provided with substantial cables, chains or other suitable methods to prevent spreading at the bottom a distance more than two-fifths (2/5) the height of the frame. They shall not be used more than three (3) tiers high, placed one over another and shall be constructed as follows:

	Dimensions in inches
Bearers two (2)	1 × 8
Leg.	1 × 8
Braces — Diagonal at bottom	1 × 4

Note: The distance between frames used as horses shall be not more than six (6) feet.

Section 203. Material of different sectional dimensions and a different type of construction may be used for horses and frames provided they conform to the requirements for allowable loads and stresses as provided in sections 23¹ and 157.²

Section 204. The placing of more than one loose brick, tile or similar loose object under the leg or frame to raise the horse or frame to the desired level, is prohibited.

Section 205. All horse or frame scaffolds ten (10) feet or more in height, wheelbarrow stocked or where employees are working below, shall be equipped

¹ Not reproduced.

² See under § 1 (c) " Scaffold Materials and Construction ".

with standard guardrails and toeboards. When placed upon other scaffolds and the adjacent space on the outside of the frames is less than the height of the superimposed portion, guardrails shall be provided on the superimposed scaffold.

Section 206. Not more than one (1) tier of horse or frame scaffold shall be placed upon another scaffold. When the working platform of such imposed scaffold is ten (10) feet or more in height such imposed scaffold shall be securely fastened, substantially braced and provided with standard guardrails.

Foot Scaffolds

Section 207. Foot scaffolds shall not exceed thirty-six (36) inches in height, measured from the level upon which the supports are placed.

Section 208. When placed upon other scaffolds or platforms whose elevation is above the surrounding area, such scaffolds shall have a minimum width of one (1) ten (10) inch plank and a maximum height of eighteen (18) inches measured from the supporting platform or scaffold and one (1) tier only shall be permitted.

Section 209. Foot scaffolds in excess of eighteen (18) inches in height shall have a minimum width of four (4) ten (10) inch planks and shall be supported on horses.

Section 210. The construction of such scaffolds shall conform to the allowable loads and stresses as given in tables, sections 23¹ and 157² of this code."

(S.R. March 1931.)

Pennsylvania

"Rule 7. *Bricklayers' square scaffolds*: (a) Platform boards shall be of at least two (2) inches in thickness and ten (10) inches in width and shall overlap the squares by at least four (4) inches but not more than six (6) inches.

(b) Squares shall be placed at intervals not greater than five (5) feet if used as a heavy duty scaffold and seven (7) feet six (6) inches if used as a light duty scaffold. Platform boards shall be so laid that they bear on all of the squares under the platform planks.

(c) Squares shall be diagonally braced both from the front and rear, and from the top and bottom; that is, from the top and bottom of one to the bottom and top of the next adjacent one.

(d) When pyramided, one square shall be placed directly above another, the braces shall be used to prevent the scaffold from pulling away from the building. Diagonal bracing for each tier shall be in accordance with paragraph (c). Scaffolds shall not be built more than four (4) tiers in height.

(e) The squares shall not be larger than five (5) feet on one side of the square.

(f) The side members of jacks shall be at least two by four (2 × 4) inch lumber and shall abut one another. Supporting blocks two by one (2 × 1) inches and six (6) inches long shall be nailed four (4) inches from the ends of the two longer side members, so as to support the shorter of the other two side members. The corners shall then be braced on both sides with braces one (1) inch in thickness, cut in the form of right angle triangles, the legs of which shall be fourteen (14) inches long. These braces shall be securely nailed to both abutting side members. This type of square may be used with the sides and bottom and top reversible.

(g) Protection shall be afforded as set forth in Rule 23³ on Protection."

(R. 1933.)

Rule 14. *Horse scaffolds*. (a) Where horse scaffolds are used inside a building, the horses shall be set squarely upon the floor, or, if no floor has been erected, a

¹ Not reproduced.

² See under § 1 (c) "Scaffold Materials and Construction".

³ See under § 6 (c) "Catch scaffolds and Protective Roofs" and § 8 (c) "Protection of the Public".

substantial temporary floor shall be constructed for this purpose. The practice of placing bricks, blocks, tiles or similar loose objects under the legs of horses to bring their upper parts to a certain desired level is prohibited. Where a horse is not quite high enough to afford proper support to the planking, a wood strip of the proper thickness shall be securely nailed to the top of the horse. On outside work, the legs of horses shall not bear directly on the ground itself, but a solid planking shall be laid upon which they shall rest. The practice of supporting horses upon thrustouts is prohibited.

(b) Horses shall be solid in construction and care shall be taken that their legs are built at the proper angles, avoiding a spread of either too little or too great a distance. The lumber used in the construction of a horse shall be not less than one (1) inch in thickness, and six (6) inches in width, except that for the top horizontal supporting member the dimensions shall be at least two by four (2×4) inches. If the length of the horse exceeds five (5) feet or if designed for heavy duty, these lumber sizes shall be proportionately increased. Inside bracing shall be provided by nailing two boards at least one (1) inch in thickness to the underside of the top horizontal supporting member, dropping them at an angle from there and nailing one to the top of the cross bracing on each pair of legs, or by other equivalent bracing.

(c) Platform planks shall be at least two (2) inches in thickness and shall be laid with their edges abutting. The distance between horses shall not exceed five (5) feet for a heavy duty scaffold and shall not exceed seven (7) feet six (6) inches for a light duty scaffold. Care shall be taken that the planks rest properly upon each horse, thus eliminating springiness in the platform. Where any space between the platform and horse is apparent it shall be overcome by following out the provisions of paragraph (a) of this rule. Care shall be taken that the platforms are not overloaded.

(d) In erecting horse scaffolds, the horses of each tier shall be placed directly over the horses of the tier next below. Where more than two tiers are built, every horse shall be nailed to the planks it supports as well as to those upon which it rests. Scaffolds shall not be built to a height in excess of twenty-one (21) feet.

(e) Where horse scaffolds are more than two tiers in height, braces shall be provided between all horses used.

(f) Guard rails and toe boards shall be provided for all horse scaffolds over six (6) feet in height. Protection shall be furnished as set forth in Rule 23¹.

(g) Where ladders are used to gain access to horse scaffolds they shall conform to the requirements set forth in Rule 20², also the plank upon which the top of the ladder rests shall be nailed to its supporting horse and such supporting horse shall be nailed to the lower planks upon which it rests, these planks in turn being nailed to the lower horses supporting them."

(R. 1933.)

Wisconsin

"Order 3515. *Square scaffolds.* Wood squares used for the support of working platforms shall be made of material not less than nominal 2×4 in. in cross sectional dimension fastened together at the corners and braced. The bracing shall be accomplished by fastening to both faces of the square boards not less than nominal 1×6 in. in cross sectional dimension, or equivalent in strength and stiffness, extending diagonally from the center of each side to the center of each adjoining side. Where the height (or width) of a square is more than 5 ft. the depth of members and braces shall be increased in direct proportion to the increase in height (or width).

Squares shall not be used in scaffolds more than three squares, or 16 ft., in height.

¹ See under § 6 (c) "Catch Scaffolds and Protective Roofs" and § 8 (c) "Protection of the Public".

² See under § 4 (a) "Ladders".

Order 3516. Horse scaffolds. Wood horses used for the support of working platforms shall be made of material not less than $1\frac{5}{8}$ in. in thickness. The beam and legs shall conform to the requirements which apply to cross-beams (Order 3514),¹ and posts (Order 3513),² respectively. The legs shall be braced to the beam. Factory made horses shall be the equivalent of the above in strength, stability and rigidity, and shall be of a type approved by the Industrial Commission.

The height of a horse shall not exceed two times the minimum spread of the legs at the bottom. Horses shall not be used in scaffolds more than two horses, or 20 ft., in height.

The beam and legs of every horse shall be continuous, not spliced, except that the legs may be made adjustable in an approved manner.

Every horse used as a scaffold, or used to support a scaffold platform, shall rest on a solid and level floor or similar footing; no such horse shall rest directly on the ground."

(G.O. 15.7.1933.)

FINLAND

" 23. Scaffolding shall not be used without the approval of the industrial inspector in cases where the staging rests on trestles more than 5 m. above the ground.

When trestle scaffolding is used in building work, the trestles shall be erected on a stable base to prevent rocking, the legs of the trestles shall be braced to prevent their slipping apart, and the trestles shall be interconnected by cross braces in cases where the height of the scaffolding above the ground exceeds 3 m.

If trestles are erected on a scaffold stage and a further stage is laid thereon, the height of the trestles shall not exceed 1.75 m."

(Res. 15.11.1927.)

FRANCE

" 6. The floorings of light scaffolds shall be close-planked. If the floor is mounted on trestles the latter shall not be more than 2 m. apart, and shall be securely fixed to firm parts of the building.

43. When platforms rest on trestles, these trestles shall be strong. Trestles shall not be placed one upon another"

(D. 9.8.1925/26.11.1934.)

GREAT BRITAIN

" 5. Every working platform erected on trestles, other than folding trestles, shall, where the trestles are of less height than five feet, be 34 in. wide, except that a width of 17 in. shall be sufficient in the case of a platform primarily used as a footing only and not used for the deposit of any material.

6. No trestle scaffold of more than three tiers or exceeding a height of 15 ft. from the ground or floor shall be used.

17. Every working platform which is supported by trestles and is more than 14 ft. from the ground, gantry or floor, . . . shall where practicable and while in actual use be provided on the side away from the wall and at each end with a suitable guard-rail and toe-board or with other efficient means to prevent the fall of persons or articles from the platform, except where and when access is required for workmen or for the movement of material.

Provided that this Regulation shall not apply to a working platform which is on the outside of a roof, nor to a working platform which is used only by glaziers, or by riveters or by bolters-up in ironwork or steelwork.

¹ See under § 2 (a) " Pole Scaffolds ".

² See under § 1 (c) " Scaffold Materials and Construction ".

Provided also that a toe-board shall not be required on a working platform used only by plasterers or painters.

26.

Trestles or other means of increasing the height of the working platform shall not be used on suspended scaffolds.

28. Planks supported by ladders, steps, or folding trestles, shall be of adequate width and thickness. Where steps are used, the platform shall not exceed 7 ft. in height."

(R. 21.6.1926.)

IRISH FREE STATE

As for *Great Britain*.

LUXEMBURG

"10. Trestle scaffolding shall not be used for work more than 5 m. high. The trestles shall be made of iron or of strong timber; in the latter case the individual parts shall be dovetailed and nailed together.

If trestle scaffolding is not placed directly on the ground, it shall not be erected except on a sufficiently strong and closely laid foundation. Trestles placed on the ground shall be placed on a sufficiently firm base.

Trestle scaffolding shall not be erected on open joists, nor shall one trestle scaffolding be placed upon another. Barrels, boxes, heaps of bricks, etc., shall not be used for the construction of scaffolding."

(O. 28.8.1924.)

NETHERLANDS

"25. Boxes, pails, stacks of bricks and the like shall not be used in the erection of scaffolding. Small auxiliary scaffolds on platforms shall not exceed 50 cm. in height. Trestle scaffolds to a height of 1.50 m. may, however, be erected on platforms resting on joists, provided that the trestles are properly constructed and firmly placed, that the scaffold is wide enough for the purpose it is intended to serve and that the platform under the trestle scaffold is solid and extends for not less than 1m. beyond the platform of the trestle scaffold."

(R. 1934.)

POLAND

Trestle Scaffolds

"20. (1) The trestles shall be solidly constructed and reinforced. They shall be installed on a strong platform. It shall be prohibited to install trestles on badly secured platforms consisting of beams or other similar unstable supports.

(2) When the trestles are over 2 m. high, their legs shall be braced diagonally by means of planks or laths.

(3) Not more than one trestle scaffold shall be set upon another.

(4) The flooring of trestle scaffolds shall be close-planked; the planks shall be laid overlapping for masonry work, and butt to butt for plastering."

(D. 23.5.1935.)

SWITZERLAND

Geneva

"33. The use of 'horses' or trestles shall be prohibited on all scaffold platforms.

When flooring is laid on trestles inside the building, the boards shall be lashed together or nailed so as to prevent any possibility of dangerous displacement. The beams supporting the flooring shall be wedged in all directions against the walls of the premises so as completely to prevent any rocking.

It shall be prohibited to place one trestle on another without intermediate flooring.

If platform flooring is laid more than 2 m. above the main flooring, it shall be provided with rigid guard-rails and toe-boards."

(R. 25.3.1930.)

CZECHOSLOVAKIA

" 35. (1) Trestle (saw-horse) scaffolds shall not be used as main scaffolds, except in the construction of one storey buildings. The trestles used for the scaffold shall consist of stout sound timber or other materials capable of supporting weights. The cross-beam of wooden trestles shall be fastened to the legs by means of tenons or plates and screws; the legs shall be properly braced against one another and the cross-beam.

(2) Trestle scaffolds shall be suitably braced lengthwise, parallel to the wall, to prevent the overturning of the trestles during the conveyance of materials, etc.

(3) When trestles are erected on the ground, care shall be taken to provide a sufficiently firm foundation. Trestles erected on scaffolds shall not stand on uncovered joists, but always on closely laid and sufficiently strong flooring.

36. (1) A sufficient number of suitable ladders shall always be available for ascending to and descending from any scaffold erected on trestles. It shall not be lawful to climb on to the scaffold by the legs of the trestles or to jump off the scaffold.

(2) The flooring of trestle scaffolds shall be 1.5 to 2 m. wide. In the case of trestle scaffolds 1.9 m. or more high, the edge of the flooring shall be surrounded by a toe-board; in addition, a firm guard-rail shall be fixed on the outer sides.

(3) The trestles shall be placed on the scaffold so as to leave sufficient free space for the transport of materials. Trestles shall not be erected one on another to raise the flooring of pole or cantilever scaffolds. Empty barrels which have been used for cement or other materials, boxes, piled bricks or pieces of brick, cans, etc., shall not be used as supports for trestles.

75.

(4) In the erection of trestle scaffolding on concrete ceilings, the legs of the trestles shall be placed on stanchions or scaffold boards of sufficient strength."

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

" 89. The height of working platforms resting on trestles shall not exceed 3.5 m. for heavy work (e.g., bricklaying) or 5 m. for light work (e.g., plastering or painting). The feet of the trestles shall be suitably strengthened, and the trestles themselves shall be sufficiently strong for the weight they will have to bear. Trestles shall be set up only on the ground or on solid, close planking."

(O. 5.5.1930.)

URUGUAY

" XIV. When work is being done from scaffolds erected on trestles, the trestles shall not be more than 2.50 m. apart and shall be securely anchored to the ground."

(D. 14.4.1915, sec. XIV.)

YUGOSLAVIA

"119. Trestles shall not be used for scaffolding unless they are braced lengthwise.

Trestles shall only be placed on solid ground. If they are placed on scaffolds, they shall not rest on single beams, but on a platform of thick planks."

(R. 25.10.1921.)

(h) SCAFFOLDS FOR DEMOLITION WORK

GERMANY

"91(1). In demolishing chimney stacks bracket scaffolds shall not be loaded with building materials. . ."

(R. 1.1.1930.)

UNITED STATES

Ohio

Demolition

"Section 62. Scaffolds or other construction equipment shall be securely, substantially and independently self-supporting unless the structural parts upon which such equipment is built or to which such equipment is attached are sufficiently strong, rigid and stable to support securely the loads and pressures imposed by such equipment."

(S.R. March 1931.)

Wisconsin

"Order 3506. *Demolition work on structures.*

. . . All floor openings in demolition work, other than those openings which are in use, shall be completely covered as described under Order 3522.¹

Where workmen or frequenters may be exposed to material or objects which may accidentally fall from upper working levels, the exposed area shall be shut off from access by means of standard guard railings, or better, or shall be roofed over solidly in a manner which will prevent any such material or object from reaching the frequented area . . ."

(G.O. 15.7.1933.)

FRANCE

"25. When the workers engaged on demolition operations have to work at a height of more than 10 m. from the ground on a wall with flooring on one side only, safety scaffolding or boarding or some other adequate device capable of preventing any worker from falling to the ground shall be erected on the other side.

When a wall over 6 m. high with no flooring on either side has to be demolished, there shall be installed on one side a safety device effectively preventing any worker from falling to the ground.

Solid scaffolding shall be erected for the demolition of a high, isolated structure, such as a factory chimney or bell-tower."

(D. 9.8.1925/26.11.1934.)

CZECHOSLOVAKIA

"63. (2) For the purpose of demolishing buildings the outer walls of which are more than 6 m. high, a longitudinal scaffold complying with the regulations, having staging not less than 1.20 m. wide, shall be erected as a rule.

¹ See under § 6 (b) "Covering of Joisting and Fencing of Floor Openings".

(3) The demolition of lower outer walls without the use of outside scaffolding shall be effected from the ground or a scaffold (e.g., a trestle scaffold) placed on the ground. The same rule shall apply to inside walls which do not afford a safe standing-place for workers. During the operations of demolition, workers shall not stand unprotected one above another.

(4) For the purpose of demolishing a wall adjoining a public thoroughfare, courtyard or other similar place, a sufficiently strong safety screen shall be erected along the wall to protect passers-by.

(O.26.3.1931.)

URUGUAY

“ XXIV. . . .

(C)

Special care shall be taken not to overload the scaffolds with rubbish, which shall be lowered by means of hoists or tubes, or slid down.

(As amended by Decree of 13 June 1930.)

(E) In the demolition of roofs use shall be made of the number of boards necessary to ensure the stability of the workers employed in pulling down arches, joisting, etc.

(F) In the demolition of inside walls, partitions and compartments, use shall be made of special scaffolds on trestles.”

(As amended by Decree of 27 September 1929.)

(D. 14.4.1915.)

(j) INTERNAL SCAFFOLDS

GERMANY

“ 46. (2) For buildings of which the exterior walls are over 7 m. high, and the roof directly covers the interior (sheds, halls, etc.) pole scaffolds shall also be erected on the inside as the exterior walls rise, unless a protective roofing as specified in section 70 (3) ¹ is installed.”

71. (1) When placing the roofing in buildings without joisting, as a rule a completely covered scaffold reaching to the workplace shall be erected inside the building. If the erection of such a scaffold is not possible the insured persons constructing the roof or employed on the ceiling shall be otherwise secured.²

(2) If roof trusses are installed completely assembled the requirements of No. 1 may be dispensed with, provided that the workplaces are safe. . . .”

(R. 1.1.1930.)

AUSTRALIA

New South Wales

Internal Scaffold for Bricklayers

“ 5. Internal scaffolds shall be constructed in a similar manner to the external scaffolds, and with timber of a similar section; trestles approved by the

¹ See under § 6 (b) “ Covering of Joisting and Fencing of Floor Openings ”.

² In such cases use may be made of:

(a) Travelling scaffolds that advance as the work progresses and must be completely covered over.

(b) Suspended scaffolds as in secs. 57 and 58*.

(c) Catch nets or sheets if none of the devices under (a) or (b) is utilisable.

* See under § 2 (e) “ Suspended Scaffolds ”.

inspector may be used in place of standards. Where the rooms do not exceed a height of 20 ft., the guard-rail may be omitted.

The standards may be omitted when the internal or divisional walls form sufficient bearing for ledgers; the distance between such bearing shall not exceed 8 ft.

Foot-planks not exceeding 16 in. in height may be used, subject to approval by the inspector.

Internal Scaffold for Plasterers, Painters, Ceiling-fixers, etc.

7. Scaffolds up to 15 ft. in height shall have standards, if Oregon pine, of not less than 9 in. sectional area, spaced not more than 10 ft. apart. Properly framed trestles may be used in lieu of standards.

Ledgers, if poles, to be similar to those for external scaffold, and, if pine timber, not less than 12 in. sectional area, with a minimum depth of 4 in.

Where the height of the scaffold exceeds 15 ft. it shall be constructed of hardwood standards of not less than 4 inches diameter at the butt and $2\frac{1}{2}$ in. at taper end, or 12 in. sectional area if sawn pine timber, to be spaced not more than 9 ft. apart. Ledgers to carry the platform of scaffolds to be of 12 in. sectional area if sawn timber; if of round timber, to be of similar section to the standards, bolted to standards with $\frac{5}{8}$ in. bolts, or properly secured with $1\frac{3}{4}$ in. manila rope. Guard-rail to be provided, and to be of 3 in. manila rope, 1 in. pipe, or 3 in. \times 2 in. timber securely fastened to hangers not less than 2 ft. 6 in. from floor; also fender board not less than 9 in. \times $1\frac{1}{2}$ in. on outside and both ends on all working stages. Openings through guard-rail and fender board allowed alongside landings only.

Generally. — Putlogs to be of hardwood; where the span does not exceed 5 ft. in the clear the sectional area shall be not less than 9 in., spaced not more than 6 ft. apart, and to have not less than $4\frac{1}{2}$ in. bearing in wall. All putlogs to be securely wedged in position.

Scaffold boards to be closely laid, and of sound timber not less than $1\frac{1}{2}$ in. thick, laid butting or lapping, but, where lapped, the laps to be not less than 9 in.

Bracing to be not less than 6 in. sectional area, hardwood poles or sawn pine timber, and placed to the inspector's satisfaction.

Scaffolds to be secured by manila rope not less than $1\frac{3}{4}$ in. in circumference and 15 ft. long, or bolts not less than $\frac{5}{8}$ in. diameter, fitted with washers. All lashings to be kept properly wedged, and bolts properly tightened up.

Where the scaffold is used in connection with ceiling work, the openings between scaffold boards must not be greater than 3 in. Scaffold boards to be secured in position, to prevent spreading.

"10. Fastenings for external or internal scaffolding may be made with manila rope not less than $1\frac{3}{4}$ in. circumference, $\frac{5}{8}$ in. iron bolts, or iron clamps approved by the inspector.

20. Where pole or trestle scaffolding is erected from floor joists or girders, the joists or girders must be temporarily close covered for a width of at least 5 ft. from the outside edge of scaffolding."

(A. 26.11.1912, Second schedule.)

Queensland

"(vii) Such trestles as may be approved by an inspector may be used in place of standards. The standards may only be omitted when the internal or division walls form sufficient bearing for ledgers. The distance between any two such bearings shall not exceed 8 ft.

(viii) When any scaffolding is used in connection with ceiling work, the opening between scaffold boards shall not be greater than 3 in., and all such scaffold boards shall be secured in position sufficiently to prevent spreading."

(R. 25.2.1916, sec. 16.)

Western Australia

Similar to *Queensland*.

UNITED STATES

California

"*Order 1139.* (a) Where a scaffold inside of a building crosses an opening six (6) feet or more in width, which extends eight (8) feet or more above the platform, a two-rail railing three feet six inches (3'6") high shall be erected across the opening to protect workmen from falling through the opening."

(S.O. 1.7.1926.)

Ohio

For interior suspended scaffolds see under § 2 (e) "Suspended Scaffolds".

Pennsylvania

"*Rule 15. Plasterers' and decorators' inside scaffolds.* (a) The use of ladders which lean against the wall, barrels, boxes or other similar unstable objects as support for planking is prohibited. Platform planks shall be at least two (2) inches in thickness and shall not have a span of more than ten (10) feet. Where A or trestle ladders are used to support planking they shall conform to the requirements set forth in Rule 20,¹ paragraph (i). The ladder shall be spread before placing the planking thereon. Trestles or horses shall not be more than two tiers high and shall be built as specified in Rule 14.²

(b) Where it is necessary to use larger scaffolds for inside work, only such scaffolds as have been approved for such work shall be used, or they shall be constructed according to the specifications contained in Rule 3³ on independent pole scaffolds. Where it is necessary to build the scaffold to an unusual height, the poles shall be of proportionately heavier material. Since plasterers' and decorators' inside scaffolds are frequently built not only lengthwise but also deep, the diagonal cross bracing, shall, in such cases, be provided in both directions. Provisions shall be made for equipping the scaffolds with guard-rails and toe-boards on the outside edges of the various platforms.

(c) 'Short Cut' connection between different parts of the same scaffold by means of unprotected planks is prohibited. Where such connection is made it shall be by a properly constructed and substantially supported passageway or temporary platform, and such passageway or platform shall be equipped with guard-rails.

(d) Protection shall be provided as set forth in Rule 23.⁴"

(R. 1933.)

FINLAND

"32. Stable scaffolds or ladders shall be used in painting, stuccoing, papering and other similar interior work. Single ladders shall not be used for

¹ See under § 4 (a) "Ladders".

² See under § 2 (g) "Trestles and Trestle Scaffolds".

³ See under § 2 (c) "Pole Scaffolds".

⁴ See under § 6 (c) "Catch Scaffolds and Protective Roofs" and "§ 8 (c) Protection of the Public".

work carried out at more than 5 m. above the ground, and the ladders used for this purpose shall be fitted with devices to prevent their slipping. Preference shall be given to double step ladders for use in this work.

..... ”
(Res. 15.11.1927.)

FRANCE

“42. Platforms used for work inside buildings shall not be supported on the filling between the beams but on cross pieces resting on the joists.

43. When platforms rest on trestles, the trestles shall be secure. Trestles shall not be superposed one above the other.

Platforms which are more than 3 m. above the ground shall be provided, like fixed scaffolds, with rigid guard-rails and with toe-boards.

43a. When the walls of a building are built from the inside, all wall openings above a drop shall, as soon as the masonry of one storey is complete, be provided with a rigid guard-rail 90 cm. in height.

If platforms used for internal work cut across such openings at a vertical distance of more than 90 cm. from the lintel, a rigid guard-rail and a toe-board shall be fitted opposite these openings.”

(D. 9.8.1925, 26.11.1931.)

SWITZERLAND

Geneva

“94. For erecting the framework of roofs of particularly high buildings not divided into storeys, such as churches, theatres and concert halls, and for erecting domes or high dormer windows, scaffolds shall be erected with close planked platforms, and regulation hand-rails and toe-boards.”

(R. 25.3.1930.)

Zurich

“41. For work inside buildings, such as masons', plasterers', painters' work, etc., scaffolds shall be erected that are well covered, and if the whole room is not scaffolded, shall be at least 1 m. wide, and if over 2.50 m high, provided with a guard-rail.

Plasterers' scaffolds shall be supported with strong, and whenever possible with adjustable cleats or scaffold trestles, and be well braced and fastened. Their erection on smooth floors, or T-beams without wooden bases shall be prohibited. Slanting shall be avoided. In front of windows over plasterers' scaffolds parapets shall be installed. Scaffold boards shall be at least 36 mm. thick.

.....
46. . . . For hoisting and erecting the roof trusses of unusually high buildings that are not divided into storeys (churches, theatres, concert halls, etc.) and have no intermediate joisting or roof joisting, and for the erection of spires, domes, tower-like dormers, etc., scaffolding shall be erected well covered with scaffold boards and provided with guard-walls.

These scaffolds, the installation of which shall be a matter for the architect, and the outside scaffolds and guard walls shall remain in place until the completion of the carpenters', tinsmiths', mechanics', roofers', and painters' work.”

(R. 31.1.1931.)

CZECHOSLOVAKIA

“22.

(2) Bricklaying from the inside of buildings (overhand) shall only be allowed in the erection of one-storey buildings. In the case of higher buildings, overhand bricklaying shall be allowed only by way of exception, in cases where there are valid reasons (legal or technical conditions, traffic, etc.) against

erecting a proper general scaffolding. In this case, the wall shall be carried as a rule to six layers of bricks above the floor of the inside scaffolding from which the bricks are being laid overhand; and at this level at least a protective cantilever scaffold, not less than 1.5 m. wide and securely enclosed by a toe-board and guard-rail, shall be erected to catch falling materials or workers. As the work proceeds this scaffolding shall be constantly re-erected at the level of the floor next below the working platform.

(O. 26.3.1931.)

URUGUAY

"3. In the inside scaffolding of buildings in general the staging shall be 90 cm. wide, and the planks composing it shall be not less than 5 cm. thick. A toe-board consisting of a plank shall be fixed perpendicularly on the outer edge of each staging and in contact with it, and the staging shall moreover be provided with two strong railings, one at a height of 60 cm. from it and the other at a height of 1.20 m. The staging shall be supported by beams with a section of not less than $7\frac{1}{2} \times 15$ cm. and not less than 1.50 m. apart. Beams containing knots or defects likely to affect the stability of the scaffolding shall not be used.

4. The provisions contained in the chapter entitled 'Construction and Demolition' of the Decree of 14 April 1915, to issue Regulations under the Act respecting the prevention of industrial accidents shall also apply to inside scaffolding."

(D. 4.1.1928.)

(k) METAL SCAFFOLDS

AUSTRALIA

New South Wales

External Scaffold (Iron) for Bricklayers and Plasterers

"8. Standards to be not more than 9 ft. apart, and to be not less than $1\frac{3}{4}$ in. \times $1\frac{3}{4}$ in. \times $\frac{1}{4}$ in. angle iron, or 2 in. \times $\frac{1}{4}$ in. channel iron. Standards and ledgers are to be formed of sufficient length of angle or channel iron to suit the height or length of scaffolding required, and to be lap-jointed with a minimum length of lap of 12 in., or butt-jointed with a fish-plate, not less than 18 in. long, lap-joint to have not less than two $\frac{1}{2}$ in. bolts, and butt-joint not less than four $\frac{1}{2}$ in. bolts.

Feet of standards to rest upon a sole plank, and to be provided with cleats to keep standards in position.

Ledgers to be not less than $1\frac{1}{2}$ in. sectional area, minimum depth $2\frac{1}{2}$ in. Ledgers must be firmly bolted or otherwise fixed to standards, and must not be more than 6 ft. apart; the first ledgers may be fixed at not more than 10 ft. from the ground where circumstances require them so.

Putlogs, in length, not more than 5 ft. in the clear, to be 2 in. \times $\frac{1}{2}$ in. iron on edge, bolted or otherwise fixed to standards; putlogs must be wedged in the wall or fastened otherwise in a manner to the inspector's approval. Intermediate putlogs to be where required by the inspector.

No bolt to be less than $\frac{1}{2}$ in. diameter.

Extension bars, of same section as putlogs, may be used for runs, subject to the inspector's approval.

Sufficient bracing must be provided, and to be securely fastened at intersections of standards and ledgers.

Scaffold boards to be of sound timber, not less than 9 in. wide and $1\frac{1}{2}$ in. thick, laid butting or lapping, but where lapping, the laps to be not less than 9 in.; scaffolds to have 9 in. \times $1\frac{1}{2}$ in. fender board on all working stages, secured to standards, also guard-rail not less than 3 ft. high, of timber not less than 6 in. sectional area, or $3\frac{1}{2}$ in. manila rope, securely attached to standards.

Openings through guard-rail and fender board allowed alongside landings only.

No scaffold to be less than 5 ft. wide.

Where iron scaffolding is to be used for plasterers' work, the standards must be spaced not more than 10 ft. apart, and the whole generally as described for bricklayers' external scaffold.

10. Fastenings for external or internal scaffolding may be made with manila rope not less than $1\frac{3}{4}$ in. circumference $\frac{5}{8}$ in. iron bolts, or iron clamps approved by the inspector."

(Act. 26.11.1912, Second schedule.)

(1) SPECIAL SCAFFOLDING REGULATIONS FOR STEEL-FRAMED BUILDINGS

GERMANY

" 32. (1) According to the nature of the work to be done adequately extensive scaffolding shall be used. It shall be erected according to sound principles from faultless materials and be of sufficient solidity and width.

(2) The workplaces shall afford secure footing to the persons employed. For this purpose the necessary coverings, working scaffolds and approaches shall be constructed. In the case of buildings divided into storeys the girders at the workplaces shall be covered to the extent that the work requires.

(3) Scaffolds shall be erected, altered and demolished under the supervision of competent persons.

(4) Scaffolds shall not be loaded beyond the authorised limit. Throwing loads, and jumping on to scaffold floors shall be prohibited.

33. (1) Scaffolds shall be secured against longitudinal and lateral displacements.

(2) On working scaffolds for assembling purposes ladders shall not be used as horizontal bearers.

(3) Under every join in the scaffold flooring two putlogs shall be placed side by side or the scaffold boards shall overlap sufficiently and rest on a putlog.

34. (1) Scaffold planks shall be squared and trued, and be at least 4 cm. thick and their bearing capacity shall not be impaired.

(2) The boards shall be laid close together and in such manner that they cannot shift. At the sides toe-boards shall be laid. The covering and toe-boards shall offer security against the fall of tools, etc.

35. On the free sides of scaffolds, at approaches to scaffold floors and at the openings in scaffold floors for the hoisting of building materials, firm landings shall be provided in so far and so long as hoisting and transport do not necessitate exceptions. In these exceptional cases specific instructions on the part of the builder shall not be required.

36. For ladder and pole scaffolds the regulations of the Building Trades Mutual Accident Insurance Association¹ shall apply.

37. Trestle scaffolds shall be used only on a solid and sufficiently firm base and only to a height of 4 m. above the ground or the flooring of fixed scaffolds. It shall be prohibited to erect them on the working platforms of other scaffolds.

38. Outrigger scaffolds shall as far as possible be avoided as working scaffolds. As such they shall only be allowed when another type of scaffold

is not practicable. Only iron girders or timbers in one piece shall be used as outriggers. The outriggers shall project into the building to a distance at least corresponding to the external width of the scaffold; their inner ends shall be anchored to fixed structural parts.

39. (1) For ascending scaffolds, stairs shall be preferred to ladders. Stairs of five or more steps shall have handrails on at least one side. Ladders shall be so constructed and installed that they are secured against slipping, collapse, and twisting, as well as against violent rocking and extensive bending. They shall project at least 1 m. beyond the place to which they lead unless some other arrangement offers adequate security against falls. The fastening of ladder rungs by nails alone, and the extension of ladders by nailing on uprights shall be prohibited.

(2) Gangplanks shall be sufficiently wide and so strong or so supported that when persons or vehicles pass over them there is no risk of their breaking, tipping, collapsing or violently rocking.

40. (1) The S and C hooks used for suspended scaffolds shall be bent hot without sharp bends and be at least 26 mm. thick. One hook alone shall not be used as a fastening; close against the first hook, a second hook or a wire rope shall be fitted. The hooks shall be carefully handled, shall not be thrown down, and before use shall be tested for cracks (external examination, tapping). Once a year they shall be completely annealed and thereafter carefully examined for fractures and cracks.

(2) Wire ropes shall be used for fastenings only if at least two turns are employed; their ends shall be secured against fraying by means of rope clamps. Wire ropes shall not be laid over sharp edges; packing of wood or the like shall be used.

(3) Wire ropes may be used alone as fastenings.

41. (1) On suspended scaffolds only light structural parts and tools shall be placed, and only in so far as they are required for work in progress. The scaffolds shall be secured against side displacement.

(2) The working platforms of suspended scaffolds shall whenever possible be laid horizontally, or else in steps; the maximum inclination allowed shall be 15°.

(3) On suspended scaffolds used by 5 or more workers, notices shall be affixed giving the maximum authorised load. Smaller suspended scaffolds shall be provided with warning notices bearing the wording 'Not to be used by several workers together. Do not throw down loads.'

42. New types of scaffold shall only be used for the first time subject to previous approval of the Association. The Managing Committee may call for plans and calculations.

43. (1) Scaffolds shall be tested at reasonable intervals and after protracted interruptions in the work, after storms, and after lengthy spells of rain or snow.

(2) When not in use structural material for scaffolds shall be stored in a dry and airy place.

44. If circumstances render the erection of scaffolding impossible, the persons employed shall be secured against falls by other means (roping, etc.)."

(R. 1.4.1934.)

CZECHOSLOVAKIA

"(3) If general scaffolding cannot be erected during the assembling of the iron framework of a building, protective scaffolding shall be erected as the work proceeds."

(O. 26.3.1931, sec. 22.)

§ 3. — Use, Maintenance, Inspection and Dismantling

(a) LOADING OF SCAFFOLDS

GERMANY

“1. The careless throwing down of loads and jumping down on to floors of inadequate bearing capacity, on to scaffolds and on to ceiling boards shall be prohibited.

2. The loading of weak structural parts, and the overloading of structural parts, scaffolds, ladders, etc., shall be prohibited.”

(R. 1.1.1930, sec. 32.)

ARGENTINA

“83. Scaffolds shall not be loaded with an excessive weight of materials or persons. . . .”

(D. 14.1.1916.)

AUSTRIA

“13. Scaffolds shall only be loaded with due regard to their structure. Outrigger, ladder, and suspended scaffolds shall only be used for the assemblage of iron or wooden structures if they are constructed with due regard to the load. For the rest, such scaffolds shall only be used for work that does not necessitate any concentration of men or accumulation of materials, i.e. only for painting, etc.”

(O. 7.2.1907.)

BELGIUM

“11. It shall be prohibited to place on scaffolds loads of a weight likely to impair the stability of the erection.”

(R.O. 31.3.1905.)

CHILE

“53. The scaffold shall not be loaded with an excessive weight of materials or persons. . . .”

(R. 30.4.1926.)

“ . . . in any case the load on scaffolds shall not exceed one-fifth of the breaking load.”

(R. 14.1.1930, sec. 395.)

UNITED STATES

California

“Order 1158. (a) No building, structure, or part thereof, or any temporary support or scaffolding in connection therewith, shall be loaded during erection, alterations or demolition, in excess of its safe carrying capacity.”

(S.O. 1.7.1926.)

FINLAND

“17.”

The maximum load for which the scaffolding is constructed shall be made known to the workers in some suitable manner. The scaffolding shall not be loaded beyond this maximum unless it is reinforced.

“ ”
(Res. 15.11.1927.)

ITALY

"7. On working platforms and platforms in general the depositing of objects, except the temporary depositing of the materials and appliances required for the construction in course shall be prohibited.

The quantity of materials deposited temporarily shall be limited in weight and volume. The weight shall always be less than that allowed by the degree of solidity and strength of the scaffold. The volume shall not impede the movements and operations required for the work.

In these limits of weight and volume, account shall be taken of the persons working."

(R.D. 27.5.1900.)

LUXEMBURG

"13. Loads the weight of which might endanger the stability of the structure shall not be piled up on the scaffolding."

(O. 28.8.1924.)

NORWAY

"117. The load on scaffolds shall always be evenly distributed and shall consist only of the materials actually required at the time for the continuance of the work. No hoisting appliances shall be set up on ordinary scaffolding unless it has been specially strengthened."

(R. 6.10.1928.)

SWITZERLAND

Geneva

"31. Measures shall be taken to prevent dangerous overloading at any point of the scaffold. Not more than four men shall stay on any one support.

Apart from cases and mortar buckets, extra loads of any kind shall be prohibited on light or suspended scaffolds."

(R. 25.3.1930.)

CZECHOSLOVAKIA

"21. (1) Scaffolding shall as far as possible be loaded evenly and in accordance with its bearing power and type of construction. In particular, overcrowding with persons or materials at any one place shall be avoided. Materials stored on the scaffold shall not be allowed to impede passage or transport. Objects shall not be thrown and persons shall not jump on to lower parts of the scaffold. Building and scaffolding materials or other objects shall not be thrown down to the ground from the scaffold, save by way of exception and on to properly fenced or guarded places.

....."
(O. 26.3.1931.)

URUGUAY

"XII. The scaffolds shall not carry excessive loads or be loaded unevenly. Flying scaffolds shall be loaded as lightly as possible. . . ."

(D. 14.4.1915, sec. XII.)

(b) MAINTENANCE OF SCAFFOLDS IN WORKING ORDER

GERMANY

"19 (1) Workplaces and passage ways including the approaches shall be in good condition, they shall be kept clear of objects hindering work or circulation.

(2) They shall be adequately lighted, be protected against falling objects and so placed that they can be used without danger.

.
.

(5) If the nature of the work or the terrain or atmospheric conditions make it impossible to avoid the workplaces or passage ways becoming slippery, suitable precautions shall be taken to prevent slipping."

(R. 1.1.1930.)

AUSTRALIA

Queensland

" 16.

(vi) The owner shall remove all rubbish from all floors, landings, runs, gangways, platforms, and scaffoldings, and keep such floors, landings, runs, gangways, platforms, and scaffoldings at all times clear and clean of rubbish."

(R. 25.2.1916.)

Western Australia

As for *Queensland*.

AUSTRIA

" 5.

In storing materials on scaffolds care shall be taken that communication is not impeded."

(O. 7.2.1907.)

UNITED STATES

Pennsylvania

" (a) No person or persons shall remove or make ineffective any safeguard, safety appliance, or device except for the purpose of immediately making repairs or adjustments; and any person or persons who remove or make ineffective any such safeguard, safety appliance or device, for repairs or adjustments, shall replace the same immediately upon the completion of such repairs or adjustments.

(b) Every employer or person exercising direction or control over any such person or persons who remove such safeguard, safety appliance or device, or over any person or persons for whose protection it is designed, shall have the safeguard, safety appliance or device so removed, promptly and properly replaced."

(R. 1933, sec. 1.)

Wisconsin

" *Order 3534. Slippery conditions.*

. . . No workman shall be permitted to work on the surface of any structural member, floor, or other working platform which becomes slippery from ice, snow, frost, painting or other cause, unless such surface is cleaned, sprinkled with sand or made non-slippery in some other effective way."

(G.O. 15.7.1933.)

FINLAND

" In order to prevent accidents through slipping, scaffold stages and workplaces in general shall be kept free from snow and ice, and when necessary shall be sprinkled with sand."

(Res. 15.11.1927, sec. 27.)

FRANCE

"47. Scaffolds . . . shall be kept clear of all rubbish and debris.

52. If there is ice, frost or snow on the scaffolds or gangways, slag, cinders, sand or other easily pulverised material shall be strewn upon them in sufficient quantity to remove all risk of slipping."

(D. 9.8.1925/26.11.1934.)

LUXEMBURG

"21. Care shall be taken that the workplaces, gangways, scaffolding and stairs are not encumbered with materials not required for immediate use, and also that the falling of materials and tools is prevented as far as possible.

In case of ice and frost the scaffold stages, gangways, and stairs, and, where beams are being laid, the upper surface of the walls, shall be strewn with sand."

(O. 28.8.1924.)

NETHERLANDS

"28. Without prejudice to the provisions of section 16,¹ no part of a scaffold that is essential to its stability shall be removed until the whole scaffold is being demolished."

(R. 1934.)

POLAND

"6. When work is being done in time of white frost or black frost, sand or some other material that prevents slipping shall be sprinkled on all passage-ways, approaches, gangways, steps, platforms, and in general places used as means of communication or at which work is being done.

7.

(2) The scaffolds shall be kept clean. Rubbish and fragments shall be constantly removed; snow shall be removed even if the work is suspended.

(3) It shall be prohibited to store and leave materials or tools on scaffolds during the night, during holidays, and during interruptions in the work."

(O. 23.5.1935.)

SWITZERLAND

Geneva

"8. In case of rain, frost, ice or snow, the planking of scaffolds, gangways and stairways and the covers of openings shall be cleaned and covered with salt, sand, ashes or other gritty substances.

24. If a scaffolding is temporarily left unused, it shall either remain intact or be completely dismantled.

28. The scaffolds, stairs, passages, etc., shall be constantly cleared of all rubbish and débris, and especially of old laths with nails in them."

(R. 25.3.1930.)

Zurich

"39. In times of rain, frost, ice or snow, the scaffold boards, gangways, ramps, scaffold platforms, joist covers, etc., and, when laying joists, the tops of the walls, shall be cleared and strewn with salt, sand, or ashes."

(R. 31.1.1931.)

¹ See under § 2 (a) " Pole Scaffolds ".

CZECHOSLOVAKIA

“ 69. (1) In the event of a glazed frost, ordinary frost or snow, the gangways, stairways, staging, runs, ramps, etc., which are exposed to the weather, and the tops of walls if work is performed thereon, shall be sprinkled with sand, ashes or similar substances. Ladders shall be freed from ice and snow.”

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

“ 102. The parts of scaffold platforms intended for the passage of persons and the parts of gangways between the transverse laths shall be cleared at regular intervals of all rubbish, stones, mud and snow. In wet or cold weather, planks and gangways shall be regularly covered with sand or ashes.

103. The technical staff and the workers engaged in building operations shall constantly ensure that there are no projecting dogs or nails on planking, handrails or uprights and that no board containing projecting nails or dogs is left lying on the planks. When any projecting nail or dog is noticed, it shall at once be removed or hammered flat.

104. The persons engaged in building operations shall immediately inform the technical staff in charge of the work of any defects noticed in gangways, platforms, etc., so that appropriate measures may be taken.

105. Platforms and gangways not used for work but left for some time without being removed shall be kept in perfect condition; handrails or toe-boards shall not be removed.

When the planks have been removed, access to gangways shall be prohibited.”

(O. 5.5.1930.)

(c) INSPECTION OF SCAFFOLDS, ETC., BY THE BUILDER OR HIS REPRESENTATIVES

GERMANY

“ 45.

(5) Scaffolds shall be examined, at suitable intervals, and also after considerable interruptions in working, storms, or long spells of rain or snow.”

(R. 1.1.1930.)

AUSTRIA

“ 12. The scaffolds shall be competently inspected at least every 14 days, and in particular after gales and after protracted interruptions in building operations, to see if they are in good order. Suspended scaffolds shall be inspected before every occasion of use, and the anchorage of their outriggers, every day. Any defects discovered shall be remedied before work is begun.”

(O. 7.2.1907.)

BELGIUM

“ 17. Employers or heads of undertakings shall test or have tested, at frequent intervals, the scaffolds and their accessories, centerings, stays, hoisting appliances, ladders, chains, ropes and similar gear so as to assure themselves of the solidity and the preservation of the equipment to be used.

Every part that is considered defective or of doubtful solidity shall be scrapped and removed so that it cannot be re-employed.

Any parts of scaffolds or ladders that break or split shall be immediately and completely renewed.”

(R.O. 31.3.1905.)

UNITED STATES

Ohio, Pennsylvania

For inspection of scaffolding machines, see under § 2 (e) "Suspended Scaffolds".

Wisconsin

"Order 3542. *Inspection and maintenance.* All equipment and temporary construction which comes within the scope of this code shall be maintained to the standards prescribed herein. Inspections shall be made sufficiently frequent to insure reasonably complete investigation of the condition of all such equipment and construction. Equipment or temporary construction which has not been in use for a period of 30 days or more shall be inspected as above before being used. Where any equipment or temporary construction, or part thereof, has become defective or weakened in any respect, the same shall not be used until it is made to conform with the provisions of this code."

(G.O. 15.7.1933.)

FINLAND

"17.
The stability of the scaffolding shall be investigated at intervals during the progress of the work."

(Res. 15.11.1927.)

GREAT BRITAIN

"14. Scaffolding in use shall be examined once a month by a competent person deputed by the employer responsible for the scaffolding, who shall within three days of his examination make an entry in the prescribed register to the effect that he has examined the scaffolding and its fittings and connections, and showing the prescribed particulars of the result of his examination. The register shall be kept on the premises to which the Regulations apply."

(R. 21.6.1926.)

IRISH FREE STATE

As for *Great Britain*.

LUXEMBURG

"9. The condition of the scaffolding and all parts thereof shall be examined at least every two months, and in particular after a storm, frosty weather, or a prolonged interruption of work."

(O. 28.8.1924.)

NETHERLANDS

"26. Scaffolding, and more especially the points at which the various parts are joined together, shall be inspected as regards strength and solidity at least once every three months and also after every spell of extreme drought, heavy rain, storm, snow or frost."

(R. 1934.)

POLAND

"7. (1) Pole scaffolds and ladder scaffolds shall be inspected periodically to verify their strength. The intervals between the inspections shall depend upon the method of construction of the scaffolds, the extent of their use and the loads that they have to carry. Independently of these periodical inspections scaffolds shall be examined after every interruption of any considerable duration in the work, and after every storm, heavy shower, and fall of snow."

The suspensions of suspended scaffolds, and the scaffolds themselves, as well as jib scaffolds, shall be examined every day before work begins. Any slight defects found in the above-mentioned scaffolds shall be removed without delay before work begins."

(D. 23.5.1935.)

SWITZERLAND

Geneva

" 26. Scaffolds that remain in use for a long time shall be carefully inspected periodically, in any case once a month."

(R. 25.3.1930.)

Zurich

" 40. Scaffolds that have been in use for a considerable time shall be carefully inspected at reasonable intervals depending on atmospheric conditions, but at least every month, or if they have been out of use for some time, before they are used again. . . ."

(R. 31.1.1931.)

CZECHOSLOVAKIA

" 20. Scaffolding shall be inspected by the overseer (general foreman) appointed by the authorised person undertaking the constructional work, at suitable intervals and in any case at least once a fortnight, and also after prolonged interruptions of the work and after gales, rainy or windy weather and heavy falls of snow. The said overseer (general foreman) shall ascertain whether the scaffolding is still in proper condition for use. Ladder scaffolds shall be examined every day before work is begun. Suspended scaffolds, together with their supporting ropes, chains, etc., shall be tested before being used on each occasion. The anchorage of outrigger beams shall be examined daily. Any defects discovered shall be remedied immediately."

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

" 93. A building contractor who uses scaffolding erected by others shall satisfy himself that all such scaffolding is in good condition, is suitable for the purpose for which he requires it and is fitted with the necessary safety devices.

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" 101. Before beams, ridge poles, rafters or other similar heavy or bulky objects are raised into position, all gangways, platforms and protective devices shall be specially examined so as to make sure that they are sufficiently strong and stable."

(O. 5.5.1930.)

YUGOSLAVIA

" 121. The scaffolds shall be tested by a specialist every fortnight, especially after high wind and long interruptions in the building operations.

Flying scaffolds and the outriggers to which they are attached shall be tested every day."

(R. 25.10.1921.)

(d) DISMANTLING OF SCAFFOLDS

AUSTRIA

" 5.

.
In the dismantling of scaffolds suitable arrangements shall be made so that planks, poles, putlogs, clamps and other large and heavy parts of the

scaffold can be safely let down by ropes or otherwise lowered without risk to persons under the scaffold.

Nails projecting from the timber shall be removed or knocked down, if possible before transporting and in any case before using the timber again.
.....
(O. 7.2.1907.)

BELGIUM

“The . . . dismantling of scaffolds shall be effected with all the precautions required to ensure the safety of the workers”
(R.O. 31.3.1905, sec. 6.)

FINLAND

“Special precautions shall be taken in the . . . demolition of scaffolding. The persons appointed to direct such work shall always be reliable persons skilled in the work.”
(Res. 15.11.1927, sec. 17.)

POLAND

“7.
(5) During the erection or dismantling of scaffolds, access to the place where the work is being done shall be prohibited to the public.
(6) It shall be prohibited to throw down materials during the dismantling of scaffolds.”
(D. 23.5.1935.)

SWITZERLAND

Geneva

“39. When scaffolds are taken down, the wood and other material shall not be thrown down or knocked down.

40. When circumstances so require, workmen who have to go on roofs to remove scaffold timber shall lash themselves with good ropes.”

(R. 25.3.1930.)

Zurich

“65. Neither the workers employed in the building operations, nor the persons in charge shall be authorised to remove scaffolds and safety devices without the authorisation of the person who erected the scaffolds, nor shall they make any alterations to them, without prejudice to the duty of notification as laid down in section 2.¹

In the dismantling of scaffolds neither building nor scaffolding material shall be thrown down, but such material shall be let down by ropes or carried down. This regulation shall apply also to the cleaning of buildings, roofs and roof gutters.

Workers who have to go on the roof to remove scaffold poles or lower scaffold parts shall lash themselves with good roof ropes.”

(R. 31.1. 1931.)

CZECHOSLOVAKIA

“24. In the dismantling of scaffolds, suitable precautions shall be taken to ensure that beams, planks, bolts, cramps, etc., are safely let down or otherwise removed without danger to persons below the scaffold. Cramps shall be held in the hand when being detached.”

(O. 26.3.1931.)

¹ See under § 1 (a) “Formalities for Erection”.

YUGOSLAVIA

" 135. When scaffolds are being . . . dismantled the necessary measures shall be taken to ensure the safety of the workers employed thereon. . ."

(R. 25.10.1921.)

§ 4. — Ladders, Gangways, Working Platforms

(a) LADDERS

GERMANY

" 62. (1) Ladders shall be stood securely and so equipped that they are secured against slipping, collapse, overturning, twisting, violent rocking and extensive sagging; if necessary they shall be held by a strong person.

(2) Ladders standing in passage ways shall be specially secured.

(3) The leaning of ladders against insecure supports (e.g. poles, window-panes, open doors) shall be prohibited.

(4) The fastening of rungs by nails only shall be prohibited.

(5) Damaged or missing rungs shall immediately be replaced by new and faultless rungs of the same type.

(6) Ladders shall not be used as horizontal scaffold supports, scaffold flooring, or gangways.

63. (1) Simple ladders shall project at least 1 m. beyond the place to which they lead unless some other arrangement ensures adequate safety in stepping on or off.

(2) If such ladders are joined together, the upper ladder shall be fastened firmly under the lower. Such ladder extensions shall, however, only be made in exceptional cases and if the load is light.

64. Double ladders standing free shall be secured against coming apart by means of chains, ropes or the like.

65. (1) On ladders the throwing of stones and bricks from hand to hand shall be prohibited.

(2) Extensive work shall not be done from simple ladders. For the performance of small jobs such ladders shall be allowed only up to 8 m. in length.

66. Auxiliary scaffolds of simple ladders, step-ladders or double ladders, with boards laid on them shall not exceed 3 m. in height; for the rest they shall be subject to the regulations concerning scaffolds.

67. Wheeled mechanical ladders may be used for repair and cleaning work if the insured persons stand on a fenced-in platform or are secured by ropes.

68. (1) On outside scaffolds ladderways and builders' stairs shall not extend uninterruptedly for more than two ordinary floors, and on inside scaffolds for not more than one ordinary floor; sufficiently wide landings shall be provided.

(2) Ladderways and builders' stairs shall not so lie one over another that falling objects can strike the lower ladder or stairs. If local conditions make this impossible, they shall be boarded in underneath and at the sides.

(3) Ladderways and builders' stairs over a passageway or a workplace shall be similarly protected."

(R. 1.1.1930.)

ARGENTINA

" 82.

(f) Ladders shall be secured and shall satisfy the conditions necessary for preventing them from sagging or moving sideways."

(D. 14.1.1916.)

AUSTRALIA

New South Wales

" 13. Ladders for bricklayers, plasterers and painters shall be of clean Oregon with hardwood rungs set in centres; batten ladders to be constructed of 3 in. × 2 in. stiles and 3 in. × 1 in. battens partly sunk into stiles and firmly nailed or screwed. In no instance shall batten ladders exceed 14 ft. in length. Batten ladders otherwise shall not be allowed, with the exception of roof ladders and gantry ladders on any building or structure upon which the work is being carried on.

All ladders must extend at least 5 ft. above the highest level served, and proper close covered landings alongside ladders to be provided."

(A. 26.11.1912, Second schedule, sec. 13.)

Queensland

" 17. (i) All ladders for bricklayers, plasterers, painters, and others shall be constructed by the owner thereof in a proper manner of clean Oregon, Kauri, Hoop, or Mountain pine; batten ladders, when square timber is used, shall be constructed of 3 in. × 2 in. stiles and 3 in. × 1 in. battens partly sunk into stiles and firmly nailed or screwed to stiles.

(ii) No batten ladders shall exceed 14 ft. in length. Every other ladder shall have hardwood turned rungs and $\frac{3}{8}$ in. iron rods through both stiles underneath every eight rungs, and screwed up with nuts and washers. All ladders shall be used in such a manner as to extend at least 5 ft. above the level served."

(R. 25.2.1916.)

Western Australia

Similar to *Queensland*.

AUSTRIA

" 15. Ladders and stairs shall before use be inspected as to their safety. Any defects discovered shall be remedied immediately. Replacement of defective rungs by nailed strips shall not be allowed.

If on buildings of more than one storey communication from storey to storey is by means of ladders, the ladders shall always be arranged in pairs, one for ascending and the other for descending, and as far as possible so that the same side is always used for the same direction; the ladders shall also be of such length that they extend at least 1.5 m., measured in the direction of the ladder, beyond the floor platform to which they lead.

Ladders shall not be so placed one over another that falling objects can strike the ladders underneath.

Ladders shall rest firmly on the ground and in addition be well fastened to the scaffold by clamps. On scaffolds, ladders shall only be placed on a base consisting of boards at least 5 cm. thick.

If ladders leading directly to a scaffold stage are placed on the outside of the stages, provision shall be made for a sufficiently wide and secure place for stepping on or off the ladder.

Double ladders (painters' ladders, step ladders, etc.) shall be provided with a device preventing them from accidentally coming apart.

.

35. The throwing of building materials from hand to hand shall only be allowed on the ground floor. The carrying of bricks by workers on ladders shall be allowed, if at all, only from one storey to the next.

37. Repairs to buildings (whitewashing, plastering, painting of outside window frames, etc.) shall be carried out on simple ladders only in the case of one-storeyed buildings; on buildings with two or more storeys, outrigger, ladder, or suspended scaffolds shall be used."

(O. 7.2.1907.)

BELGIUM

"(13) Ordinary ladders shall be made of good quality material in a perfect state of preservation, and free from cracks or defects likely to weaken them. They shall offer every desirable guarantee of solidity and rigidity. The application of paint or a coating to hide a defect shall be prohibited.

Ladders shall be long enough to allow the workers to pass in perfect safety from them to the platforms or installations that they serve and conversely, from these platforms or installations to the ladders.

It shall be prohibited to use any ladder from which a rung is missing or of which a rung is broken, split or loose.

(14) The feet of ladders shall rest on a sufficiently firm surface. If necessary the two uprights shall be wedged to prevent slipping.

It shall be prohibited to fasten the ladder by one of its rungs unless the rung is strong enough and is fixed in the uprights in such a way that it cannot turn.

Measures shall be taken to prevent the fall or overturning of double ladders.

Suspended ladders shall be fastened with all desirable care and so as to avoid swinging movements.

(15) As far as possible use shall be made of different ladders for acceding to and leaving the working platforms.

The feet of ladders shall be preserved from all shocks liable to cause an accident.

The movement of persons near the feet of ladders shall be prevented as far as possible."

(R.O. 31.3.1905.)

BULGARIA

"46. Ladders used for the transport of materials shall be solidly built, provided with suitable rungs, etc.; and their slope shall not exceed 30 per cent. Ladders may be used as such up to a height of 4 m. If this height is exceeded the ladder shall be provided with a small platform. The ladders and platforms shall have a minimum width of 80 cm., and be provided with suitable hand rails.

47. Portable ladders shall be solidly built, with their rungs housed in the uprights and carefully nailed. Ladders may be extended on condition that the join is secure. All necessary precautions shall also be taken to prevent the ladder from slipping. It shall be prohibited to use the rungs less than 1.20 m. from the top of the ladder."

(O. 4.5.1935.)

CANADA

Alberta

"(f) All ladders shall extend at least four feet above any scaffold, staging or floor."

(Revised Statutes, 1922, Ch. 193, sec. 6.)

Manitoba

As for *Alberta*.

CHILE

“ 54. Ladders, in addition to possessing the necessary solidity, shall be provided at the top with hooks and at the bottom with devices that prevent them from slipping.”

(R. 30.4.1926.)

“ 391. The ladders serving the different floors of the scaffold shall be constructed rigidly, with the necessary solidity, shall have side railings, and be firmly secured at least at one of their ends.”

(R.14.1.1930.)

UNITED STATES

California

“ Order 1144.

(h) The furnishing or use of broken or weak ladders, or ladders with weak or missing rungs, shall be prohibited.

(i) Side rails, when of wood, shall be straight-grained and sound. Lumber with knots greater than one-half ($\frac{1}{2}$) inch in diameter shall not be used. Spruce, Oregon pine, Norway pine, yellow pine, or approved wood of equal strength shall be used.

(j) Rungs, when of wood, shall be straight-grained and absolutely free from knots. White ash, oak, hickory, birch or approved wood of equal strength shall be used.

(k) Rungs shall be doveled, mortised or securely fastened by metal supports to the side rails.

(l) Ladders shall be erected, equipped, or guarded to prevent slipping.

(m) All ladders shall be so constructed as to carry safely the load to be placed thereon.

(n) On buildings more than two storeys high and under sixty (60) feet, double ladders shall be provided and left in place until the stairways are ready for use.

(o) All ladders shall extend at least two and one-half ($2\frac{1}{2}$) feet above the upper landing.

(p) Ladders shall be secured against displacement. The following ways are suggested:

1. By nailing a cleat on the floor in front of the ladder.
2. By nailing the feet rigidly to the floor.
3. By having the feet of the ladder shod with steel points
4. By lashing the ladder on top.
5. By installing safety shoes.

(q) Whenever a ladder is placed over an opening the bottom landing shall be at least (4) feet square.”

(S.O. 1.7.1926.)

(Orders 1145-1155 give detailed specifications for portable ladders, masons' portable ladders, portable square side ladders, masons' portable square side ladders, masons' portable cleat ladders, extension ladders, portable step ladders, sectional ladders, trestle ladders, and extension trestle ladders.)

Ohio

Ladders

“Section 268. All ladders not specifically mentioned herein shall be of sufficient strength to resist safely double the strain of the heaviest load that will be placed upon it in use.

Section 269. Wood side rails shall be of thoroughly seasoned material free from shakes, cross grain, checks and decay. Knots shall not exceed one-half ($\frac{1}{2}$) inch in diameter and shall not be nearer than one-half ($\frac{1}{2}$) inch to the edge of the rail or three (3) inches of the rung. Wood shall be of Red, White or Sitka Spruce or species equivalent thereto in strength.

Section 270. Wood rungs shall be of thoroughly seasoned material free from knots, shakes, cross grain, large checks or decay. They shall be of white oak, ash or material equivalent thereto in strength and wear.

Section 271. Wood shall be inserted in holes in the side rails and in all cases securely fastened, with a uniform spacing between rungs, not to exceed twelve (12) inches on centres.

Section 272. Ladders constructed of other materials than specified herein may be used, provided the strength and rigidity of the ladders specified herein are maintained.

Section 273. Ladders with weakened, broken or missing treads, rungs or cleats or broken side rails shall not be used, and ladders which have developed defects shall be withdrawn from service and repaired or disposed of. Cleats shall not be used to repair rung ladders.

Section 274. All ladders when in place shall have a substantial bearing for all rails at the bottom and when inclined shall have a substantial support at or near the top.

Section 275. All ladders placed where there is danger of slipping shall be secured by the use of cleats, metal points, safety shoes, lashing or other effective means.

Section 276. All ladders with spreading bases such as step and trestle ladders shall be equipped with rigid spreaders or other means to prevent their premature opening or closing.

Section 277. (a) All fixed ladder landings shall be equipped with standard guardrails and toeboards so arranged as to give the safest possible access to the ladder. Such platform shall be not less than twenty-four (24) inches in width.

(b) Rails of fixed ladders to landings shall extend a distance of at least thirty-six (36) inches above the landing. The rungs may be omitted above the landing. Where an employee must step a greater distance than fourteen (14) inches from ladder to roof, tank, etc., a landing shall be provided.

(c) The landing distance shall not be greater than the rung spacing of the ladder.

Section 278. If fixed ladders are used to ascend to heights exceeding thirty (30) feet, a landing or rest platform shall be provided for each thirty (30) feet or major fraction thereof unless provided with a safety cage. This section shall not apply to watertowers, masts, smoke stacks, material hoists or towers.

Section 279. Portable ladders shall not be used with a pitch such that the horizontal distance from the wall to the foot of the ladder shall exceed one-fourth ($\frac{1}{4}$) of the unsupported length of the ladder unless it is securely braced to prevent sagging.

Section 280. Ladders shall not be placed in front of doors opening toward the ladder unless the door is fastened open, locked or guarded.

Section 281. Single ladders not constructed to be used as sectional ladders shall not be spliced together to form a longer ladder unless such splicing together shall provide and maintain the strength and rigidity required in this code for ladder construction.

Section 282. Effective means shall be provided to prevent the displacement of ladders placed in dangerous zones or in public thoroughfares.

Section 283. Construction ladders shall be provided and maintained in place during working hours until temporary or permanent stairways are ready for use.

Section 284. The use of single rail ladders is prohibited except as provided in sections 229 to 231 ¹ inclusive of this code."

(S.R. March 1931.)

Pennsylvania

"Rule 20. (a) Where a runway, stairway or safe inside means of access to a scaffold is not provided, a ladder shall be provided for all such scaffold platforms more than forty-five (45) inches above the ground or floor.

(b) Ladders for scaffolds shall be built according to the specifications contained in the regulations for ladders: except where such construction is conclusively proved impracticable by reason of unusual working conditions. Particular care shall be taken regarding the quality of wood used in the construction of all ladders.

(c) Where practicable all ladders shall be placed on the outside of a scaffold. If the landing is on a platform extending from the scaffold platform or building, such landing shall be provided with guard rails. If the ladder is built inside of a scaffold the opening in the flooring through which it comes shall be protected by guard rails.

(d) The use of single-pole ladders is prohibited.

(e) Ladders shall be securely fastened at the top and bottom. The top shall extend not less than thirty-six (36) inches above the platform or floor served and the landing rung shall be as close to the level of the floor or platform as possible. Ladders shall not be placed on boxes or other insecure footings to bring them up to a desired height.

(f) Ladders shall not exceed thirty (30) feet in length except where absolutely necessary and in such case the extended ladder shall be securely fastened to the lower ladder by means of two iron rungs, threaded at both ends, placed firmly in the slots provided for such purpose and held in place by tight-fitting nuts and washers. The side bars at the base of the slots shall be additionally strengthened to prevent splitting of the wood.

(g) Where workmen carry material up or down a ladder, not more than one workman shall be permitted on a single ladder at one time. Where work being done necessitates frequent use of a ladder for this purpose, the remaining alternative is to build two ladders, one for up-travel and one for down-travel.

(h) Where ladders are of a length sufficient to possess a tendency toward springiness when sustaining weight, bracing shall be provided to overcome same. This particularly applies to extended ladders.

(i) Where A or trestle ladders are used to support planking, they shall be constructed according to the specifications set forth in the regulations for ladders."

(R. 1933.)

Wisconsin

"Order 3524. Ladders.

1. General requirements for all ladders. Every ladder used under this code shall conform to definition (Order 3502).²

Note. — Good practice in the design and construction of ladders is described in Bulletin No. 351, Bureau of Labor Statistics, U.S. Department of Labor. Washington, D.C.

¹ See under § 7 (a) "Roof Work: General Regulations".

² The definition is as follows: "A ladder is a framework consisting of two or more approximately parallel stringers to which are attached horizontal cleats or rungs uniformly spaced used for descending from, and ascending to, elevated places."

2. Design and construction of all ladders. Every ladder shall be designed and constructed to support the maximum load, including weight of materials and persons, within limits of unit stresses specified under Order 3513,¹ except as hereinafter specified.

The rungs and treads of every ladder shall be of uniform size and spacing, but in no case spaced more than 14 inches center to center. In the case of wooden ladders, round rungs shall be fastened to stringers by mortising, cleats shall be fastened to stringers in a manner such that no part is damaged, and treads shall be inset in the stringers or shall be fastened thereto by means of approved metal brackets. The stringers and rungs shall be braced and tied to prevent distortion of the ladder or spreading of the stringers. Metal rungs or treads shall be bolted, riveted or welded to the stringers.

Where ladder stringers are spliced or arranged to be extended, the splice or extension device shall develop the full strength of the stringers.

Ladders constructed of material other than wood shall be the equivalent of wooden ladders in strength.

3. Use of all ladders. Where permanent or temporary stairways are not in place, or runways are not provided, ladders shall be provided for safe and easy access to elevated working levels and shall be left in place until permanent or temporary stairways are ready for use. Where workmen carry materials or tools up or down a ladder, such ladder shall be inclined such that the horizontal distance from the foot of the ladder to a plumb line drop from the upper point of support is not less than one fourth of the length of the ladder. In any case, where a ladder is inclined less than above, such ladder shall be fastened in place to prevent tipping.

In buildings more than two storeys in height, ladders provided for the floor to floor access shall be fixed double ladders.

All stringers of fixed ladders shall extend not less than 3 ft. above upper landing, shall have bearing at top and bottom, and shall be secured in some effective way to prevent slipping.

No ladder shall be permitted in any hoistway or other shaft in locations exposed to falling objects from operations at higher elevations in or adjoining the shaft.

Note. — For illumination requirements see Order 3538.¹

4. Portable ladders, special requirements. Coast type Douglas fir, southern yellow pine, Sitka spruce, or approved wood of equivalent strength and resilience, shall be used in the construction of the stringers of all portable ladders. The rungs of all portable ladders shall be made of white ash, hickory or oak. The cleats of all portable ladders shall be made of white ash, hickory, oak, yellow pine, Douglas fir or wood of equal strength.

Portable ladders built on a job shall be not more than 24 ft. in length and shall conform to the following requirements:

Length (feet)	Inside width (in inches) not less than		Minimum nominal cross section (inches)	
	At bottom	At top	Stringers	Cleats
Not more than 16	20	16	2 × 4	1 × 4
More than 16, not more than 24	24	20	2 × 6	1 × 4

All wood used in the building of portable ladders shall be sound and straight grained, except that ladders built and used only on one project may be of No. 1 common lumber free from unsound features. A member will be considered

¹ Not reproduced.

straight grained if the deviation of the grain from the axis of the member is not more than one in twenty. The wood of which the rungs, or cleats, are made shall be such that there will be no knots in the finished member. There shall be no knots in the stringers, except sound knots not more than $\frac{1}{2}$ in. in diameter and located not less than $1\frac{1}{2}$ in. from the edges of the finished stringers.

As a practical measure of the strength and resilience of factory built portable ladders, as designed under this order, every such ladder, when tested as a simple beam on two supports, shall sustain for 10 minutes a static load of 200 lbs. applied at center of the rung located midway between supports, with a maximum total deflection of the ladder not greater than shown by the following table, and without taking a permanent set or developing any indication of failure:

Length of extended ladder (feet)	Distance of supports from ends (inches)	Total deflection (inches)
12	3	$2\frac{3}{4}$
14	3	$4\frac{1}{2}$
16	3	$6\frac{3}{4}$
18	3	$9\frac{1}{2}$
20	3	$11\frac{1}{2}$
22	3	14
24	3	$16\frac{1}{2}$
26	3	19
28	3	$21\frac{1}{2}$
30	3	$23\frac{1}{2}$
32	6	24
34	6	26
36	6	29
38	6	34
40	6	37
42	9	39
44	9	41
46	9	44
48	9	48
50	9	54
52	12	55
54	12	58
56	12	64

When in use, every portable ladder shall have solid bearing for both stringers at top and bottom, and shall be secured to prevent slipping, such as

- (1) By nailing a cleat to the floor in front of the ladder.
- (2) By lashing at top or bottom.
- (3) By nailing the feet rigidly to the support.
- (4) By installing approved safety shoes.

Where portable ladders are treated for preservation, only a transparent coating or other preservative which does not hide the grain and wood structure shall be used.

5. Stepladders and trestle ladders. Stepladders and trestle ladders used under this code shall be not more than 20 ft. in height.

Note. — A trestle ladder consists of two portable ladders, hinged or otherwise fastened together at one end, with braces and ties so as to be self-supporting like a stepladder.

Stepladders and trestle ladders shall be so constructed that when open they shall have a spread, inside to inside of opposite legs at the bottom, of not

less than $5\frac{1}{2}$ in. for each 12 in. height of stringer, measured along the stringer, including the vertical extension section at the top in the case of extension trestle ladders.

While in use, every stepladder more than 10 ft. in height shall be held by an attendant."

(G.O. 15.7.1933.)

FINLAND

" 25. Ladders shall be made of sound materials, and the dimensions both of the rungs and of the uprights shall be fixed with due regard to the materials and the load.

Ladders placed practically vertical shall have wooden rungs drilled or notched into the uprights. Rungs which are split by nails, worn or otherwise defective shall be replaced by new rungs. The distance between the rungs shall be short in cases where ladders are used for the conveyance of materials.

The steps of ladders or stairways with a moderate slope shall not be less than 15 cm. wide, and the ladder shall have at least one handrail projecting at least one metre beyond the level to which the ladder leads.

Ladders shall always be erected on a firm and solid base and in such a way that they cannot slip or fall. Ladders sloping steeply shall be fixed so as to prevent their falling backwards or slipping sideways. Working ladders placed on scaffolding stages shall not be more than 3 m. high."

(Res. : 15.11.1927.)

FRANCE

" 44. Ladders shall be so arranged and fixed that they cannot slip at the bottom or rock.

They shall reach at least 1 m. beyond the point against which they rest, or be continued to that height by an upright to serve as a handrail at the top.

The rungs shall be rigid and firmly housed in the uprights.

A single ladder shall not be used to bridge a space of more than 5 m. unless it is supported in the middle.

Ladders connecting the floors shall be staggered and a safety landing shall be constructed at each floor.

Ladders shall not be used for carrying loads exceeding 50 kilogrammes.

45. The uprights of double ladders shall be fastened together during use or fixed in such a way as to prevent them separating accidentally."

(D. 9.8.1925/26.11.1934.)

GREAT BRITAIN

" 29. Every ladder used as a means of communication shall rise at least 5 ft. above the place of landing, shall not stand on loose bricks or other loose packing, but shall have a level and firm footing, and shall be securely fixed so that it cannot move from its top point of rest; undue sagging shall be prevented. Every ladder which cannot be secured at the top, shall, if over 25 ft. in length, have a man stationed at the foot to prevent slipping, or shall be securely fastened at the base. A ladder having a missing or defective rung shall not be used.

No ladder made of sawn timber shall be used unless of adequate strength and the steps securely notched in or housed."

(R. 21.6.1926.)

IRISH FREE STATE

As for Great Britain.

ITALY

"5. . . . Ladders in addition to possessing the necessary strength shall be so constructed as to ensure the safety of their position during use, or shall be held at the foot by a worker."

"Ladders . . . shall be constructed and secured regularly and solidly having regard to the weight that they have to bear."

(R.D. 18.6.1899, 27.5.1900, sec. 6.)

LUXEMBURG

"16. Scaffold ladders shall be made of sound wood and the rungs shall be in good condition. They shall be fastened both on the ground and at the top, and shall extend not less than 1 m. above the floor to which they lead. Ladders shall not be placed one above another in such a way that falling objects are liable to strike the lower ladders. As far as possible separate ladders shall be used for ascending and descending.

Ladders with missing rungs or with rungs which are nailed, broken, split or loose, shall not be used.

If for purposes of work a ladder must be leant against a building situated in a thoroughfare, an adult person shall be placed at the bottom of the ladder to supervise it."

(O. 28.8.1924.)

NORWAY

"114. All ladders shall be strongly and securely constructed and shall be so set up that they cannot slip. On the ground floor, a gangway of planks shall lead from the main platform to the foot of the ladder, and a similar gangway shall lead from the top of the ladder to the scaffold platform. The width of these gangways and platforms shall be not less than 60 cm.

In the case of ladders inside the building, the joisting beneath them shall be covered with planking to a sufficient extent to ensure, as far as possible, that falling objects cannot fall more than the height of one storey.

Ladders used for the transport of building materials on scaffolding shall be provided with guard-rails of sufficient strength. They shall, as a rule, be not less than 60 cm. wide."

(R. 1934.)

NETHERLANDS

"36. If sawn timber is used, the following dimensions shall be observed:

- | | |
|----------------------------------|--------------------|
| (a) for ladders up to 3 m. — | poles: 5 by 7 cm. |
| | rungs: 2 by 7 cm. |
| (b) for ladders from 3 to 5 m. — | poles: 5 by 10 cm. |
| | rungs: 2½ by 7 cm. |

The circumference of round timber poles for ladders shall be not less than 25 cm. at the upper end, increasing towards the lower end. The rungs shall be not less than 3 by 7 cm.

Ladders of other types or lengths shall be of appropriate dimensions. Rungs shall be mortised into the poles and not simply fastened by nails or screws.

37. Scaffold platforms and other places above or below ground level at which work is performed shall at all times be accessible by means of suitably placed ladders, unless these places can be reached without danger in some other way.

Diagonal bracing or anchoring attachments shall not be fixed to the rungs of ladders.

Every ladder shall extend at least 1 m. beyond the point to which it leads, unless an extension pole 5 by 7 cm. is securely attached to one pole and extends to that height.

Every ladder shall be secured against slipping and shall be sufficiently braced to prevent undue bending.

38. Ladders leading to different storeys shall, where possible, not be placed immediately above each other, unless precautions against the fall of objects are taken.

If more than 30 persons are working above the ground level, there shall be at least two ladders for ascending and descending.

39. Ladders shall not be used as supports for gangplanks."

(R. 1934.)

SWITZERLAND

Geneva

" 82. Ladders shall be placed and fixed so as not to slip at the bottom or overturn; they shall extend beyond the place on which they lean by at least 1 m. or be extended by an upright of the same height forming a handrail at the top.

The rungs shall be rigid and firmly housed in the uprights.

Ladders connecting the different storeys shall be staggered and a protective landing shall be constructed at each storey.

Ladders formed of nailed laths or planks shall be prohibited, unless they are supported over their whole length (roofers' ladders).

83. Double ladders shall, while in use, have their uprights lashed or blocked so as to avoid any accidental spreading.

84. Manholes at ladder landings, and the landings mentioned above, shall be provided with a regulation handrail with a toe board.

85. The painting of cornices, dripstones, roofs, etc. by means of ladders leaning on roofs or frontages shall not be allowed at a height exceeding 5 m. unless the ladders can be securely fastened at the top and blocked. The same shall apply in general to all painting, rough casting, and other light work such as repairs to balconies, etc."

(R. 25.3.1930.)

Zurich

" 27.

On high scaffolds stairs with landings shall be constructed. Ladders shall only be allowed where considerations of space render the construction of stairs with landings impossible.

The ladders shall be so arranged that falling objects cannot strike the lower ladders.

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33. For every scaffold¹ platform ladders shall be placed having a minimum width of 45 cm., a maximum width of 75 cm. at the bottom, and rungs not more than 28-30 cm. apart. The ladders shall be placed vertically or slanting, outside the bracing poles and up to a height of 1 m. above the landing of the topmost platform. At the level of each scaffold platform a landing 45 cm. wide shall be constructed, or, if the ladder is some distance from the scaffold, a landing platform. Sufficiently strong step ladders may also be fixed securely outside the scaffold aslant, and at an easily climbable inclination (70-75°).

Outside working hours ladders shall be boarded over up to a height of 2 m.

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36. Trestle ladders and lean-to ladders shall not in future be used for painters', whitewashers' and similar light work, such as the repair of balcony railings, at a height of over 5 m. above the ground.

¹ Scaffolds for plasterers, painters and repairers.

The washing of frontages shall be allowed over a height of 6 m. only by means of wheeled mechanical ladders. If the ladder is a considerable distance from the frontage solid platforms shall be fitted at the sides.

Hoisting ropes that no longer possess the necessary bearing capacity shall be changed.

Small repairs to drain pipes, and repairs at small places on frontages, and the painting of masts, may, with the special authorisation of the scaffolding inspectorate, be carried out from ladders."

(R. 31.1.1931.)

CZECHOSLOVAKIA

" 39. (1) The ladders used in constructional work shall be properly made of sound, straight wood which is sufficiently strong. Iron ladders may be used. Before use the ladders shall be examined to verify their safety. Any defects observed shall be remedied immediately.

(2) The rungs shall be placed at intervals of about 33 cm., and securely housed in the uprights or fixed in such a manner as to prevent their revolving even when dry. Damaged rungs shall be replaced at once by new ones. Missing or damaged rungs shall not be replaced by iron rods or by laths nailed or screwed on without being notched in or housed. The strength of a ladder shall not be dangerously reduced by the housing of laths in the uprights.

(3) Ladders more than 6 m. long shall be held together by flat rungs or iron staples at the ends and in addition at intervals of not more than 4 m. to prevent them from falling apart.

40. (1) Ladders shall be sufficiently long to project at least 1 m. to 1.5 m. beyond the floor of the storey to which they lead.

(2) If the storeys are very high or the ladders very long, the ladders shall be well braced to prevent bending and lateral swaying.

(3) Ladders shall always be set on a firm base, and not in any case on boxes, bricks or similar unstable materials. Further, they shall be properly secured to prevent slipping or overbalancing. On scaffolds they shall be placed on a flooring of sufficiently strong planks and secured by cramps. A ladder used as a means of communication shall not in any case lead merely to single joists or poles.

(4) If ladders placed outside the scaffolding and leading directly to an upper storey are used, sufficiently wide and safe means of access and egress shall be provided.

41. (1) In buildings of more than one storey, if passage from one storey to another is effected by means of ladders, where more than ten workers are employed there shall always be at least two ladders, one for ascent and the other for descent, and wherever possible they shall be arranged so that persons passing from one ladder to another in the same direction shall always turn to the same side.

(2) Ladders shall not be placed on the edge of a scaffold, nor one above the other in such a manner as to expose the lower ladders to objects falling from above.

(3) Openings through which ladders lead to the floor shall be surrounded by a strong guard-rail, except on the side next the ladder.

42. (1) If it is found necessary to place one ladder upon another, they shall be adequately braced, and shall be lashed together by means of the attachment of the wider end of the upper ladder to the lower ladder with sound hemp rope or with iron collars (loops) over a length of not less than 1 m. to 1.5 m. Such lengthening of ladders shall be only by way of exception and for the purpose of light loads. Ladders shall not be joined end to end by means of battens that are merely nailed on.

(2) Double ladders (painters' ladders, step-ladders, pairs of steps) shall

be safeguarded against opening outwards dangerously by a properly secured rope, chain, wire or the like.

43. (1) In rooms with smooth floors and on stairways, ladders shall be specially secured against slipping during work.

(2) Portable extension ladders may be used for light repairs and cleaning, provided that the workers employed thereon are equipped with a safety belt fitted with a safety hook.

(3) Ladders shall not be used for the regular conveyance of loads, and shall not be used in a horizontal position as gangways, working places and the like.

(4) In all work carried out at a height above 5 m. from a ladder which is merely leaning against a support, e.g. when cleaning windows, signs, etc., the ladder shall be held by a strong person.

(5) The lower ends of the uprights of ladders shall always be secured against slipping outwards.

.....

67. (1)
Bricks shall not be handed up by workers standing on ladders over a distance exceeding that from one storey to the next.

.....

(5) Repairs to buildings (whitewashing, plastering, painting the outside of window frames, etc.), shall not be carried out on single ladders, except on the ground floor and in any case, not higher than the first floor. On the upper storeys flying, ladder or suspended scaffolds shall be used."

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

" 7. Ladders and peg ladders shall be regularly cleared of mud, refuse, snow and foreign bodies.

In winter, sand or ashes shall be strewn on ladders and peg ladders.

.....

107. Portable ladders shall be made of good materials, the dimensions being in proportion to the length of the ladders.

The use of portable ladders in which the rungs (steps) are fixed by means of nails and not housed shall be prohibited.

The joining of two or more ladders shall be prohibited unless the join is securely made with the help of metal connections (clamps with bolts, collars, iron bands, etc.), but not with nails. The thickness of the two ladders shall be such that after they are joined there shall be no swaying or sagging when they are in use.

When a ladder has to be placed near a building in the street an adult worker shall remain at the foot as a precautionary measure.

Extension ladders shall be fitted with secure connecting parts, so that they cannot come loose when in use.

108. Ladders intended to be used leaning against walls shall be of such length that the work can be performed from a rung not less than 1 m. from the top of the ladder.

No one shall work from a higher rung unless there is some suitable support. When there is a platform at the top of the ladder it shall be protected on three sides."

(O.5.5.1930.)

YUGOSLAVIA

" 123. Ladders used for building work shall always be examined before use.

The wood of which ladders are made shall be of good quality. The rungs shall not be nailed but housed in the uprights. No rung shall be missing.

When communication between two storeys is by ladder only there shall be at least two ladders—one for ascending and another for descending.

Ladders shall be sufficiently long to project 1.50 m. beyond the upper storey.

One ladder shall not be placed under another, as anything falling from the higher one might damage the lower one.

Ladders shall be firmly anchored to the ground and securely fastened to the scaffolding.

No ladder shall rest on unplanked beams unless they are at least 5 cm. wide.

Ladders shall not be supported at any storey by the rungs, but only by the uprights. Hanging ladders shall be secured against swinging.

The uprights of trestle ladders shall be tied together to prevent them from slipping apart accidentally."

(R. 25.10.1921.)

(b) GANGWAYS, RUNS, RAMPS, TEMPORARY STAIRS, ETC.

Gangways, Runs and Ramps

GERMANY

"(1) Gangways, ramps and passage ways over joisting or girders shall be at least 0.80 m. wide, or if intended for the transport of materials, at least 1.25 m. On inclined gangways, as a protection against slipping, strips shall be placed over the whole width. Inclined gangways shall not slope more than 35°.

(2) Gangways and ramps shall be so fastened and supported that when walked or ridden on they do not break, collapse, tip or rock."

(R. 1.1.1930, sec. 69.)

AUSTRALIA

New South Wales

"All runs, gangways, or similar means of communication between different portions of the building or scaffolding shall be of sufficient width to ensure safety, and shall have a thickness of not less than 2 in.

Gangways or runs of two or more planks shall be cleated or otherwise fastened together to prevent unequal sagging.

The pitch of any run or gangway shall not be greater than 1 in 6."

(A. 26.11.1912, Second schedule, sec. 20.)

Queensland

"16. (i) All runs, gangways, or similar means of communication between different portions of a scaffolding or building shall be at least 18 in. wide. If composed of two or more boards, such boards shall be fastened together in such a manner as will prevent unequal sagging.

Every such run gangway or similar means of communication shall, where practicable, have a guard rail not less than 2 ft. 6 in. or more than 3 ft. above such platform, run, gangway, or similar means of communication."

(R. 25.2.1916, sec. 16, as amended by R. 3.10.1929.)

Western Australia

Similar to *Queensland*.

AUSTRIA

"16. Gangways shall as far as possible be made wide enough for two persons to cross.

The slope of the gangway shall as far as possible be 1 in 3 or less and in any case not more than 1 in 2. The surface shall be provided with strips of wood laid crosswise at intervals of one pace, and if slippery shall be sprinkled with cinders, sand, etc.

Every gangway shall be provided with hand-rails on the outside and also at any window or door openings; hand-rails shall also be placed on the inner side if the gangway is more than 0.4 m. from the masonry."

(O. 7.2.1907.)

UNITED STATES

California

"Order 1140. (a) Ramps extending from storey to storey shall be equipped with guard rails not less than three feet six inches (3' 6") high. When used for wheelbarrows, ramps shall be not less than three (3) feet wide. firmly cleated together and secured at each end to prevent the ramp from sliding. On such ramps the two outer planks shall be provided with cleats to afford foothold.

Order 1142. (a) Inclined runways, where erected for the use of workmen, shall be not less than twenty (20) inches in width, and supported so as to prevent deflection and springing action.

(b) Cleats eight (8) inches or more in length shall be securely fastened on such runways, not more than sixteen (16) inches apart.

(c) Runways extending from storey to storey, which are used in place of stairways, shall have on open sides railings not less than forty-two (42) inches in height."

(S.O. 1.7.1926.)

Ohio

"Section 145. Unless otherwise specified, planks used for platforms, scaffolds, stagings, runways, ramps, etc., shall be laid close together. Such planks may be overlapped or butt jointed. In the former case they shall extend not less than four (4) inches the inside face of the bearings, unless securely fastened. Where planks are butt jointed and nailed to supports, an inch and one-half (1½) bearing for spans greater than two (2) feet, and a three-quarter (¾) inch bearing for spans two (2) feet or less, are permitted. Where planks project more than one-tenth (1/10) of their length beyond the bearing they shall be securely fastened to prevent tipping or railed off over bearings.

Section 146. Ramps and runways shall be not less than two (2) ten (10) inch planks wide, except in private residence construction where they shall be not less than two (2) eight (8) inch planks wide. Runways and ramps used for rolling equipment except upon the ground, rough, temporary or finished floor, shall be not less than three (3) ten (10) inch planks in width. Ramps and runways shall be inclined not more than one (1) foot rise in three (3) feet run and where the rise exceeds one (1) foot in five (5) feet run, nailed cleats shall be applied to the top surface. Runways and ramps shall be substantially supported and braced to prevent excessive spring or deflection and shall have planks thereof so placed and secured as to prevent loosening or displacement, with battens on the underside to prevent uneven deflection in the planks.

Section 147. For requirements as to handrails, guardrails, intermediate rails, toeboards, side screens and overhead protection on runways or ramps, see Sections 239 to 245,¹ 254, 255,² 265 and 266³ inclusive of this code.

¹ See under § 1 (c) "Scaffold Materials and Construction".

² See under § 6 (c) "Catch Scaffolds and Protective Roofs".

³ See under § 4 (b) "Temporary Stairs, etc. ".

Section 148. Runways, ramps and inclines shall be kept reasonably clean.”

(S.R. March 1931.)

Pennsylvania

“Rule 17. (a) Runways and ramps where used in scaffold work, shall be substantially constructed and supported. Runways shall be composed of planks, each at least ten (10) inches in width. The minimum width of runways shall be thirty (30) inches. They may be laid so that their edges abut but in that case a wide, solid bearing shall be provided. When the planks overlap, the plank that runs from below shall be placed so that it laps over the one running from above. The planks of runways and ramps shall be securely nailed in position and the supports shall be well braced.

(b) The construction of runways and ramps at an incline greater than one (1) foot rise in three (3) feet is prohibited. Runways and ramps constructed at a greater incline than one (1) foot rise in six (6) feet shall be provided with cleats running crosswise and flush with the edges of the inclined platform. The cleats shall be of ample size, spaced not more than eight (8) inches apart, and securely fastened into position. They may be laid in sections across the platform so as to form a barrow track. Runways and ramps shall be kept free from snow and ice in the winter and if necessary treated with sand and ashes.

(c) Where runways or ramps are more than ten (10) feet in height, the outside edges at least shall be provided with guard rails and toe boards. Where, such runways pass near deep holes, railroad tracks, high tension wires, mortar beds or similar dangerous places, guard rails and toe boards shall be provided on both sides of the runways or the dangerous points effectively guarded.”

(R. 1933.)

Wisconsin

“Order 3523. *Construction and protection of runways.* Every elevated runway, that is, every runway which is not directly on the permanent floor structure, scaffold construction or falsework shall be built as required for scaffolds, except as otherwise provided in this order.

The floor of every elevated runway shall be of planking not less than $1\frac{5}{8}$ in. in thickness, individual planks not less than $9\frac{1}{2}$ in. in width (nominal 2×10 in.) laid tightly together and secured to the supports by nailing or other approved means, or equivalent construction.

The width of every runway shall be not less than as follows:

- (1) Where the runway floor is not more than 30 in. above the supporting level $9\frac{1}{2}$ in. (nominal 2×10 in.).
- (2) Where the runway floor is more than 30 in. but not more than 5 ft. above the supporting level 17 in. (two nominal 2×10 in.).
- (3) Where the runway floor is more than 5 ft. above the supporting level 28 in. (three nominal 2×10 in.).

The width of platform and the distance between railings for any runway shall be such that there will be a clearance, between railings and vehicle and between vehicles, of not less than 6 in. for all vehicles used thereon, but in no case may such width or distance between railings be less than 28 in.

Temporary guard railings (Order 3503) ¹ shall be provided on runways as follows:

- (1) On all open sides of every runway the floor of which is more than 30 in. above the supporting level,
- (2) On the outer side of all runways at turns,
- (3) At wall openings as in the case of scaffolds.

¹ See under § 1 (c) “Scaffold Materials and Construction.”

Temporary toeboards (Order 3504) ¹ shall be provided on the open sides of every elevated runway at those places where the runway floor is 8 ft. or more above a work space or similar exposed area.

Note. — For the protection of runways across floor openings, see Order 3522.²

No runway shall have an incline of more than 1 ft. of vertical rise in 3 ft. of horizontal run:

Every runway shall be maintained in safe structural condition (Order 3513) ¹ while in use, and the floor shall be kept unobstructed and free of objects or material that may cause persons to stumble or slip.

Note. — Cleats fastened to the runway floor may often be used to advantage in the elimination of a slipping hazard.”

(G.O. 15.7.1933.)

FINLAND

“ 26. The planks used in the construction of gangways and runs intended for traffic shall be held together by laths across the under side or in some other suitable manner, so that they do not cause falls through unequal swaying. The relevant parts of the provisions issued for scaffold stages shall apply in this connection.

Gangways used for the conveyance of materials or as passageways on scaffolding or open joists shall always be at least 1 m. wide, except in the case mentioned in the last paragraph of this section.

Runs made for the performance of incidental work shall consist of not less than three planks laid side by side, and shall not be less than 0.5 m. wide.

Gangways or runs leading to bricklayers' scaffolds shall consist of four planks, and shall not be less than 0.6 m. wide.

27

Scaffold stages, platforms and transporter bridges on which work is to be done and which are situated more than 5 m. above the ground or the corresponding solid base shall have railings along the outer sides of the scaffolding. Such railings shall have both a handrail and a toe-board.

Gangways and the steps, ladders and stairways leading thereto shall have railings on their outer sides.”

(Res. 15.11.1927.)

FRANCE

“ 46. Outside landings and the various gangways, ramps, etc., shall be securely constructed and provided with guard-rails and toe-boards in the manner specified for platforms. Their width shall not be less than 60 cm.

47. Scaffolds, landings, gangways and staircases shall be kept clear of all rubbish and débris.”

(D. 9.8. 1925/26.11.1934.)

GREAT BRITAIN

“ 7. Every board or plank forming part of a working platform or run shall be supported at proper distances and near each end by a putlog or other support, and no such board or plank shall project beyond its end support to a distance exceeding four times the thickness of the board or plank.

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¹ See under §1 (c) “ Scaffold Materials and Construction ”.
² See under §6 (b) “ Covering of Joisting and Fencing of Floor Openings ”.

9.

(b) Boards or planks which form part of a run mainly used for the movement of barrows shall not overlap each other unless steps, such as the provision of bevelled pieces, are taken to facilitate the movement of the barrows.

10. Every gangway or run shall be at least 17 in. wide when any part is more than 5 ft. above the ground or floor except a gangway or run leading to a plasterer's scaffolding in the interior of a room or place in which the height from the floor to the ceiling does not exceed 14 ft. All planks forming a gangway or run shall be so fixed and supported as will prevent undue or unequal sagging. When the slope renders additional foothold necessary, proper stepping laths the full width of the gangway shall be provided at suitable intervals not exceeding 2 ft.

Provided that this Regulation shall not apply to any run which is of a width of at least 11 in. and is of adequate thickness and is mainly used for the movement of barrows unless:

- (a) The said run reaches a height of more than 5 ft. above the ground, or unless;
- (b) The said run is placed over an excavation which is more than 7 ft. deep and 10 ft. across.

11. No working platform, run or gangway more than 2 ft. above the ground or floor shall be supported by loose bricks, drain pipes, chimney pots or other unsuitable material.

12. No working platform, gangway or run shall be used for working upon until its construction is completed and the safeguards required by these Regulations properly fixed.

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16. Every gangway and staircase shall be kept free from any unnecessary obstruction, and if over 12 ft. from the ground or floor, shall be provided with a suitable handrail or other efficient means to prevent the fall of persons, except where and when access is required for workmen or for the movement of material.

Provided that this Regulation shall not apply to a temporary gangway used only in connection with glazing or with the erection of ironwork or steelwork."

(R. 21.6.1926.)

IRISH FREE STATE

As for *Great Britain*.

ITALY

" 4.

The gangways or ramps leading to the scaffolds shall also be provided with handrails.

(5) The ramps shall not be less than 80 cm. in width when they are intended solely for pedestrians not carrying loads, and 1.20 m. when intended for the transport of materials.

Their inclination shall not exceed 50 per cent. Long ramps shall be broken by landings for resting at suitable intervals; on the planks of ramps strips of wood shall be fixed crosswise at distances not exceeding the pace of a loaded man."

(R.D. 27.5.1900.)

LUXEMBURG

" 20. Gangways used for the transportation of materials shall be placed at an angle of less than 30°. The flooring thereof shall be made of strong planks

and shall be not less than 1.20 m. wide. Safety in the use thereof shall be ensured by battens nailed across it, and railings with fender boards on both sides. Gangways shall be so placed that falling material shall not strike a lower gangway.

21. Care shall be taken that the workplaces, gangways, scaffolding and stairs are not encumbered with materials not required for immediate use, and also that the falling of materials and tools is prevented as far as possible.

In case of ice and frost the scaffold stages, gangways, and stairs, and, where beams are being laid, the upper surface of the walls, shall be strewn with sand."

(O. 28.8.1924.)

SWITZERLAND

Geneva

" 75. Inclined gangways or ramps shall be at least 1.20 m. wide and provided with regulation hand-rails if they are more than 2 m. high. They shall be fitted with transverse strips of wood securely nailed so as to form steps 40 cm. apart when the slope exceeds 20 per cent., and shall always be kept perfectly tidy.

The slope of ramps shall never exceed 40 per cent."

(R. 25.3.1930.)

Zurich

" 27. Where the permanent stairs cannot be used, construction stairs shall be erected. On large buildings there shall be two construction stairs. Whenever possible these shall be provided with landings; the height of the steps shall not exceed 25 cm. Ramps shall be nailed with cleats. Outside construction stairs or ramps shall be provided on both sides, and inside stairs along the stair openings, with toe boards and a guard rail at a height of 90 cm. affixed on the inside. For ramps, a platform shall be constructed at least every two storeys. For stone and plaster carriers the necessary resting places shall be provided.

As a rule inside stairs and ramps shall be at least 90 cm. wide, and outside ones at least 1.20 m. The slope of the latter shall not exceed 40 per cent.

On high scaffolds stairs with landings shall be constructed. Ladders shall only be allowed where considerations of space render the construction of stairs with landings impossible. . ."

(R. 31.1.1931.)

CZECHOSLOVAKIA

" 44. (1) If finished stairways are not available, at least one safe ramp (inclined bridge, run) shall be provided for every building. In the case of extensive building operations, two or more such ramps shall be provided.

(2) Ramps shall whenever possible be made sufficiently wide to allow two persons to pass each other without inconvenience, and shall be sufficiently strong not to sag to any considerable extent beneath the weight of the persons using them. The gradient of a ramp shall if possible be 1:3 or less, and shall not in any case exceed 1:2.

(3) The surface of the ramp shall be provided with stepping laths laid across it a step apart. If the surface of the ramp is slippery, it shall be strewn with ashes, sand or similar substances. The boards shall be firmly nailed to the props.

(4) Strong guard-rails shall be fixed on the outer side of every ramp and across any windows, doorways or similar openings adjacent to it, in the manner prescribed for fencing scaffold stages. If the ramp is more than 40 cm. away from the wall, such guard-rails shall also be fixed along the whole length of its inner side.

(5) Ramps and stairways by which loads are usually conveyed shall have resting places at every floor, on which the loads can be placed.”

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

“ 21. Gang planks shall be laid end to end without gaps and without overlapping.

22. Gang planks shall be kept free from mud, snow, and ice.

95. Planks shall be fitted closely together and shall not present any unevenness; the ends of the planks shall not overhang.

96. Gangways shall be provided with transverse laths firmly fixed in position.

97. Gangways shall be sufficiently strong not to sway under the weight of workers carrying loads. They shall be sufficiently wide for the nature of the work.

98. Gangways shall be fitted with handrails on both sides. A plank not less than 18 cm. wide, placed edgewise, shall be nailed to the foot of the uprights supporting the handrails, so as to prevent the workers' feet from slipping off the plank while loads are being carried.

99. At least every second cross-bar (putlog) supporting the planks of a gangway shall project not less than 50 cm. at each side, so that the bracing supporting the handrails can rest on them.

100. Building materials shall not be dumped, even temporarily, on gangways. Any obstruction on a gangway shall be immediately removed.”

(O. 5.5.1930.)

URUGUAY

“ XVI. Ramps shall be at least 0.80 m. wide, shall be provided with cleats nailed crosswise and stout guard rails, the uprights of which shall be securely fastened to the scaffold or the floor of the building. If intended for the transport of materials they shall be at least 1.20 m. wide, with a landing at least at every two storeys. Ramps shall not have a slope of more than 40 per cent. Care shall also be taken to keep them tidy.”

(D. 14.4.1915, sec. XVI.)

YUGOSLAVIA

“ 124. Sloping wooden gangways shall be sufficiently wide to enable two people to pass each other. The slope shall not exceed 1 in 2; where possible, it shall be only 1 in 3.

Wooden gangways shall have stepping laths one pace apart to prevent slipping.

A guard-rail shall be fitted on the outer side of sloping wooden gangways.

Ladders shall not be used as substitutes for sloping gangways except in exceptional circumstances, when technical difficulties render the use of a gangway impossible.”

(R. 25.10.1921.)

Temporary Stairs, etc.

AUSTRIA

“ 30.

When the stairs have been put in, until permanent hand rails are placed, temporary hand rails shall be provided.”

(O. 7.2.1907.)

UNITED STATES

California

"Order 1141. (a) Standard railings when used in connection with stairwells and stairs, shall be not less than forty-two (42) inches in height, and shall be provided with an intermediate rail between top rail and floor, and constructed in a substantial manner, and free from protruding nails and splinters. The uprights shall be not less than two by four (2×4) inches or equivalent in cross-section spaced not more than eight (8) feet apart. The top rail shall be not less than two by four (2×4) inches or equivalent cross-section and mid-rail not less than seven-eighths by four ($7/8 \times 4$) inches.

(b) Standard toeboard shall be installed around stairwells and stair openings.

(c) The installation of stairways in new buildings shall be started as soon as working conditions will permit.

(d) Stairways, until permanently enclosed, shall be guarded on all open sides with standard railings. Landings of stairways shall be guarded with standard railings and toeboards.

(e) Stairways on which the treads have to be filled in later with cement or other material shall have wooden treads not less than seven-eighths ($7/8$) inches thick, full width of the tread, firmly fitted in place and replaced when worn below the level of the metal nosing. Where skeleton iron stairs are installed, they shall have wooden treads and landings not less than one and one-quarter ($1\frac{1}{4}$) inches thick. All treads and landings shall be free from protruding nails and splinters.

(f) Temporary wooden stairways or permanent stairways, on which the permanent guard-rail has not been erected, shall be provided on all open sides with temporary guard-rails three feet six inches ($3' 6''$) in height, measured vertically from the center of the treads, and shall be constructed in a strong and substantial manner.

(g) In all buildings sixty (60) feet or over in height, where permanent stairways have not been erected, at least one line of temporary stairways shall be installed. They shall have guard-rails three feet six inches ($3' 6''$) in height, measured vertically from the center of the treads, constructed in a strong and substantial manner.

(h) All temporary stairways shall have treads made of one by eight (1×8) inch sound lumber. The stringers shall not be less than two by ten (2×10) inch sound lumber spaced not more than two (2) feet apart."

(S.O. 1.7.1926.)

Ohio

Stairways

"Section 262. Buildings more than sixty (60) feet in height in which it is impracticable to install the permanent stairways for construction use shall be provided with not less than one (1) temporary stairway between floors; of substantial construction; fitted with not less than two (2) inch by eight (8) inch treads securely fastened in place; and with runs or flights built at angles not to exceed forty-five (45) degrees to the floors or other horizontal parts to which they connect or land.

Section 263. Permanent steel or other metal stairways that are to be finished with marble or other treads when used during construction shall be fitted with securely fastened and maintained temporary treads made of not less than two by six (2×6) inch planks or the treads filled to the level of the nosing with solid material. This requirement shall not apply during the period of actual construction of the stairways themselves.

Section 264. Temporary and permanent stairways used for construction purposes shall be fitted with substantial and securely fastened treads and tightly floored landings or gratings.

Handrails

Section 265. Handrails shall be provided on the open sides of stairways and stair landings, except where such stairways and landings are protected by studding or other permanent construction.

Section 266. Handrails shall be not less than thirty (30) inches in height measured vertically from the front edge of tread of stairway or thirty-six (36) inches in height from the floor or landing; with supporting uprights spaced not more than eight (8) feet on centers and both substantially constructed of not less than two (2) inch by four (4) inch timber or other material and spacing of equal strength and practicability.

Section 267. Provision shall be made to prevent the use of stairways not equipped as required in the preceding sections during construction operations."

(S.R. March 1931.)

Pennsylvania

"Rule 19. (a) Stairways used during construction work shall be strongly built and shall have treads of full width and depth. The treads shall be spaced so as to afford easy ascent and descent. The stairs and landings of stairways shall be solid and shall be provided with guard-rails at exposed sides.

(b) Stairways used during construction work shall be kept clear of debris and other obstructing material at all times and shall be maintained so as to insure always safe passage. Where temporary stair treads are placed over finished or unfinished stairs such treads shall be securely fastened.

(c) Stairways shall be used instead of ladders wherever practicable to do so."

(R. 1933.)

Wisconsin

"Order 3525. *Temporary and permanent stairs.* On buildings where the floor construction has progressed to a point 40 feet or more above grade, one or more permanent or temporary stairs extending from the first to uppermost floor shall be provided.

Temporary stairs shall have a pitch of not more than 45 degrees with the horizontal, and shall have treads of nominal 2×8 in., or wider. Nominal 2×8 in. plank treads shall have a span of not more than 4 ft., nominal 2×10 in. plank treads shall have a span of not more than 6 ft. The temporary stair stringers shall be not less than $1\frac{5}{8}$ in. in thickness, shall support a uniform load on the stairs of not less than 100 lbs. per square foot, and shall be fastened and braced in place to prevent slipping or turning.

Where steel treads have a standing front edge, and such stairs are used during construction before the tread receives the permanent filling, the tread shall be filled flush with the top of such standing edge with wood not less than nominal 2×6 in., blocked or cleated in place to prevent slipping.

Where flat steel stair stringers are designed to receive treads of marble, slate, or other material, they shall either be provided with temporary treads of nominal 2 inch plank the full width of the tread, fastened to the metal, or such stairs shall be shut off by means of guard railing or enclosure and shall not be used except by the stair builder."

(G.O. 15.7.1933.)

FINLAND

"Stairways leading to scaffold stages, platforms and transport bridges on which work is to be done and which are situated more than 5 m. above the ground or the corresponding solid base, must have railings on their outer sides."

(Res. 15.11.1927, sec. 27.)

FRANCE

"47. . . . Stairs shall be kept clear of all rubbish and debris.

48. When the ladders have been taken away and the workers are using the stairs the latter shall be provided with temporary rigid handrails."

(D. 9.8.1925/26.11.1934.)

GREAT BRITAIN

" 16. Every gangway and staircase shall be kept free from any unnecessary obstruction, and if over 12 ft. from the ground or floor, shall be provided with a suitable handrail or other efficient means to prevent the fall of persons, except where and when access is required for workmen or for the movement of material. . . ."

(R. 21.6.1926.)

IRISH FREE STATE

As for Great Britain.

LUXEMBURG

" 18. . . Provisional handrails shall be placed on stairs which are already in position, until the permanent banisters are fixed."

(O. 28.8. 1924.)

SWITZERLAND

Geneva

" 76. Stairs shall be provided with a barrier consisting of two rails, complying with the requirements of Section 23,¹ and kept in place until the permanent barrier is completely installed.

The barriers shall be independent of the construction props supporting the steps. Barriers fixed to standards sealed in plaster shall be prohibited.

78. The boarding protecting the treads of stair steps shall be fixed very securely and be free of all rubble. The same shall apply to bricks sealed in plaster and laid for the same purpose.

Stairs shall always be kept free of anything which might hinder traffic. The steps shall be cleaned regularly and the coverings (planks or bricks) kept in a good condition."

(R. 25.3.1930.)

Zurich

" 27. Where the permanent stairs cannot be used construction stairs shall be erected. On large buildings there shall be two construction stairs. Whenever possible these shall be provided with landings; the height of the steps shall not exceed 25 cm. . . . Outside construction stairs or ramps shall be provided on both sides, and inside stairs along the stair openings, with toe-boards and a guard-rail at a height of 90 cm. affixed on the inside. . . . For stone and plaster carriers the necessary resting places shall be provided.

As a rule inside stairs and ramps shall be at least 90 cm. wide, and outside ones at least 1.20 m. The slope of the latter shall not exceed 40 per cent.

On high scaffolds stairs with landings shall be constructed. Ladders shall only be allowed where considerations of space render the construction of stairs with landings impossible. . . ."

(R. 31.1.1931.)

¹ See under § 4 (c) " Working Platforms ".

CZECHOSLOVAKIA

" 44.

(5) Ramps and stairways by which loads are usually conveyed shall have resting places at every floor, on which the loads can be placed.

58.

(3) Stairways already erected shall be provided with strong temporary guard-rails pending the fitting of the permanent rails. The other stairways shall also be safeguarded on their open side by strong guard-rails. . . ."

(O. 26.3.1931.)

(c) WORKING PLATFORMS: GENERAL RULES

Note. — For special regulations concerning working platforms on pole scaffolds, outrigger scaffolds, suspended scaffolds, internal scaffolds, trestle scaffolds, etc., see under "Pole Scaffolds", "Outrigger Scaffolds", etc.

ARGENTINA

" 82. Scaffolding employed in the construction or repair of buildings shall satisfy the following conditions:

(a) a minimum width of 1.20 m.;

(b) be constructed of planks, well joined together and 5 cm. (0.05) thick, with a toeboard on both sides 30 cm. (0.30) high;

(c)

(d) above the level of the scaffold shall be placed two horizontal cross pieces, one at 50 cm. (0.50) and the other at 1 m., well secured and solid. . . ."

(D.14.1.1916.)

AUSTRALIA

New South Wales

" All working platforms above the height of 8 ft. shall be at least 18 in. wide, and where practicable to have a guard-rail not less than 2 ft. 6 in. above platform."

(A. 26.11.1912, Second schedule, sec. 20.)

Queensland

" (ii) Every scaffold board forming part of a working platform shall be supported at each end by a putlog, and shall not project more than 6 in. beyond such putlog, unless lapped by another board which rests partly on or over the same putlog and partly upon putlogs other than those upon which the said board rests.

(iv) All working platforms at a greater height than 8 ft. from the ground or floor shall be at least 18 in. wide, and, where practicable, shall have a guard-rail not less than 2 ft. 6 in. or more than 3 ft. above such platform."

(R. 25.2.1916, sec. 16.)

Western Australia

Similar to *Queensland*.

UNITED STATES

Ohio

For planks, see under § 4 (b) "Gangways, Runs, etc."

For guard rails and toeboards see under § 1 (c) "Scaffold Materials and Construction".

Pennsylvania

"(e) Planks used for flooring shall be of uniform thickness so as not to cause unevenness and in laying same care shall be taken that "traps" are avoided.

(f) Guard-rails and toe-boards shall be provided on the outer edges and ends of the platforms of all types of scaffolds six (6) feet or more above the ground (including rails across window openings which extend more than thirty-four (34) inches above the scaffold platform) except riveters' outrigger scaffolds and window jack scaffolds. Guard-rails and toe-boards shall be securely fastened to the uprights on the side facing the platform.

(g) Guard-rails shall be the equivalent in strength of wood rails two by four (2×4) inches dressed and shall be not less than thirty-four (34) inches in height. They shall be secured to uprights at intervals of not more than eight (8) feet.

(h) Toe-boards shall project not less than six (6) inches above the top of the platform planks and shall be erected so as to leave no space between the platform planks and the toe-boards."

(R. 1933, Rule 1.)

Wisconsin

"Order 3519. *Scaffold platforms.* Planks for scaffold platforms shall be not less than nominal 2×10 in. The span of scaffold planks shall not be greater than 8 ft. between supports, except that in the case of scaffolds for light work, such as for painting, paper hanging and similar work (but not for mason work, plastering or other work involving heavy materials) the span of nominal 2×10 in. (or wider) planks may exceed 8 ft. but not more than 12 ft., if selected planks which have been tested with a load at least two times as great as the greatest loads which the planks are to carry are used. In scaffold platforms on which wheeling is to be done, the span of planks shall not exceed 6 ft. for wheelbarrows and 5 ft. for carts. Boards not less than nominal 1×10 in. may be used for spans not greater than 3 ft. on scaffolds used only by painters, decorators and similar light uses. The planks and boards used in a scaffold platform shall be of uniform thickness.

The safe load for planks and boards under this Order is indicated in the following tables. The tables apply to No. 1 common Douglas fir, coast type, allowed stress 1,200 pounds per square inch. The safe load for other woods is in direct proportion to the allowed stress. The safe load for planks and boards of other widths is in direct proportion to the width.

SAFE LOAD AT CENTER FOR NO. 1 COMMON DOUGLAS FIR PLANK $1\frac{5}{8}$ IN. THICK
(NOMINAL 2 IN. MATERIAL)

Span (in feet)	Width of plank (in inches)		
	$7\frac{1}{2}$	$9\frac{1}{2}$	$11\frac{1}{2}$
5	265	334	405
6	220	278	337
7	188	239	289
8	165	209	254
9	147	185	225
10	132	168	202
11	120	151	184
12	110	141	170

Where Wisconsin hemlock or equal planks not less than $1\frac{3}{4}$ in. in thickness are used, the safe loads in the above table shall be reduced 15 per cent.

SAFE LOAD AT CENTER FOR NO. 1 COMMON DOUGLAS FIR BOARDS $\frac{13}{16}$ IN. THICK

Span (in feet)	Width of boards (in inches)		
	7½	9½	11½
2	165	209	253
3	110	139	169
4	82	104	126

Where the load is distributed over the length of the plank or board, the safe loads in the above tables may be doubled.

Every scaffold plank or board which does not project at least one foot beyond the support shall be nailed to the support or shall have a cleat or drop bolt at the end to prevent slipping off the support. Scaffold planks shall not cantilever more than fifteen times the thickness, or more than one-tenth the length, of such planks. All cantilever planks shall be securely anchored where necessary to prevent tipping and slipping.

In no case shall load bearing cantilever ends of scaffold planks or scaffold flooring be hidden from view, or placed at intermediate points in a scaffold runway or floor. Cantilever ends of scaffold planks or scaffold flooring shall always be placed at the outside edges or extreme ends of working floor or platform.

Note. — This is to avoid the creation of traps in a working platform.

The minimum width of flooring or platforms for various types of scaffolds shall be as follows:

	Inches
For the accommodation of painters, decorators and similar workmen in buildings and structures.	11½
For the accommodation of men and tools only, where the platform is not more than 6 ft. above the ground or floor, inside or outside of buildings or structures.	19
For the accommodation of men and tools only, except painters, decorators and similar workmen as above, where the platform is more than 6 ft. above the ground or floor, inside or outside of buildings or structures.	23
For the accommodation of men, materials and tools only . . .	46
For the accommodation of men, materials, tools and vehicles. .	57

Where scaffolds extend over moving machinery or other dangerous areas, the scaffold platform shall cover, or be arranged adequately to guard, such machinery or areas.

The platforms of all scaffolds shall be solid, except that the platforms of painters', decorators', lathers' or plasterers' scaffolds, and of scaffolds for similar light work not more than 12 ft. above the floor may have planks or boards not more than 6 in. apart.

Order 3520. Guard railing and toeboards for scaffolds.

A temporary guard railing (Order 3503) ¹ shall be provided on all open sides of:

- (1) All swinging scaffold platforms (except on riveters' scaffolds).
- (2) All masons' and plasterers' scaffold platforms which are more than 12 ft. above the ground or floor.

¹ See under § 1 (c) "Scaffold Materials and Construction".

(3) All carpenters' scaffold platforms used for wrecking, removing falsework or similar work where the platform is more than 12 ft. above the ground or floor.

(4) All scaffold platforms on which wheeling is done. Every scaffold adjoining a floor opening shall have a standard guard railing on the side next to the opening.

In the case of interior scaffolds where there are openings in a wall which forms the guard on one or more sides of a scaffold platform, a temporary guard railing shall be provided for all such openings which begin at a point less than 30 in. above the platform and extend more than 42 in. above such platform, except that this requirement need not apply to openings on which work is being done.

A temporary toeboard (Order 3504) ¹ shall be provided on the open sides, including that portion opposite all openings in walls and floors in the case of interior scaffolds, of the platforms of all mason scaffolds, scaffolds on which wheeling is done and other scaffolds where material or tools may slide or be pushed from the working platform.

On masons' scaffolds, a netting or equivalent guard between toeboards and railings shall be provided on scaffolds more than 40 ft. in height."

(G.O. 15.7.1933.)

FINLAND

" 27. Scaffold stages, platforms and transport bridges on which work is to be done and which are situated more than 5 m. above the ground or the corresponding solid base shall have railings along the outer sides of the scaffolding. Such railings shall have both a handrail and a toe-board.

Work shall not be done on the parts of the staging planks which extend beyond the putlogs of the scaffold.

.

28. There shall not be sufficient space between the planks of a gangway or run or scaffold stage for any object to slip through or for a worker accidentally to put his foot through."

(Res. 15.11.1927.)

FRANCE

" 36. The floorings of light scaffolds shall be close-planked.

38. Light scaffolds, like fixed scaffolds, shall be provided with rigid guard-rails and toe-boards.

The guard-rails of scaffolds on which workers work in a sitting position shall consist of two rigid rails fixed, one 90 cm., and the other 45 cm., above the floor."

(D. 26.11.1934.)

GREAT BRITAIN

" 4. Every working platform which is more than 5 ft. above the ground or floor:

(a) Shall be closely boarded or planked, provided that a space not exceeding 3 in. may be left between any two boards or planks of a platform used only by plasterers or painters;

(b) (i) Shall be at least 17 in. wide if used as a footing only and not for the deposit of any material;

¹ See under § 1 (c) " Scaffold Materials and Construction".

(ii) Shall be at least 34 in. wide if used for the deposit of material;

(iii) Shall be at least 43 in. wide if used for the support of any higher platform:

Provided that a working platform upon which stone is dressed or roughly shaped shall be at least 51 in. wide and, if used for the support of any higher platform, shall be at least 60 in wide;

(c) Shall, if part of a pole or gabbard scaffold, be at least 42 in. below the top of the standards wherever possible.

Provided that this Regulation shall not apply to a working platform which is on the outside of a roof.

Provided also that a width of at least 10½ in. shall be sufficient for a working platform used for glazing a roof if the said platform is bolted or otherwise firmly fixed at one end to a bracket securely hooked to a purlin and rests securely at the other end on another purlin.

5. Every working platform erected on trestles, other than folding trestles, shall, where the trestles are of less height than 5 ft., be 34 in. wide, except that a width of 17 in. shall be sufficient in the case of a platform primarily used as a footing only and not used for the deposit of any material.

6. No trestle scaffold of more than three tiers or exceeding a height of 15 ft. from the ground or floor shall be used.

7. Every board or plank forming part of a working platform or run shall be supported at proper distances and near each end by a putlog or other support, and no such board or plank shall project beyond its end support to a distance exceeding four times the thickness of the board or plank.

8. Where there is a space between a wall and a platform used for plastering the wall, this space shall not exceed 18 in. in breadth.

9. (a) Boards or planks which exceed 1½ in. in thickness and form part of a working platform or run shall not overlap each other. Provided that this Regulation shall not apply to any platform or run supported by trestles or by a gabbard scaffold if steps, such as the provision of bevelled pieces, are taken to reduce to a minimum the risk of tripping.

.....

11. No working platform, run or gangway more than 2 ft. above the ground or floor shall be supported by loose bricks, drain pipes, chimney pots or other unsuitable material.

12. No working platform, gangway or run shall be used for working upon until its construction is completed and the safeguards required by these Regulations properly fixed.

.....

17. Every working platform which is supported by trestles and is more than 14 ft. from the ground, gantry or floor, and every working platform which is otherwise supported and is more than 12 ft. above the ground, gantry or floor, shall where practicable and while in actual use be provided on the side away from the wall and at each end with a suitable guard-rail and toe-board or with other efficient means to prevent the fall of persons or articles from the platform, except where and when access is required for workmen or for the movement of material.

Provided that this Regulation shall not apply to a working platform which is on the outside of a roof, or to a working platform which is used only by glaziers or by riveters or bolters-up in ironwork or steelwork.

Provided also that a toe-board shall not be required on a working platform used only by plasterers or painters.

.....

19. At least one-third of the putlogs used for supporting any working platform more than 12 ft. above the ground or floor shall remain in position until the scaffolding is finally removed, and one half of the number so remaining shall be securely fastened.

.....

27. No working platform resting on wooden bearers let into the wall at one end and without other support shall be used unless the bearers go right through the wall, are securely fastened, and are of sufficient strength.

No figure or bracket scaffold supported or held by dogs or spikes driven into the wall shall be used.

28. Planks supported by ladders, steps, or folding trestles, shall be of adequate width and thickness. Where steps are used, the platform shall not exceed 7 ft. in height."

(R. 21.6.1926.)

IRISH FREE STATE

As for *Great Britain*.

ITALY

"(3) Every platform shall be suitably anchored to the building under construction, except in cases where the nature of the construction does not allow this and other arrangements have to be made.

(4) Every floor of a working scaffold shall have at the sides guards formed of planks placed on edge, resting on the floor itself, and not less than 20 cm. in height, to prevent the fall of materials and other objects.

The guards shall be supplemented by longitudinal handrails forming a parapet."

(R.D. 27.5.1900.)

NORWAY

"115. The platforms of all scaffolds shall be sufficiently close-planked to ensure that no materials or tools can fall between the planks. Care shall be taken that the planks cannot tip up or be displaced.

The platforms of all scaffolds for mason's work shall be fitted with toe-boards, to a height of not less than three planks. All outside scaffolding shall be fitted from the first storey upwards with a strong guard-rail about 1 m. above the platform."

(R. 6.10.1928.)

POLAND

"9. (1) Barrels, boxes, loose material, bricks or similar objects shall not be employed in the place of scaffolds or to support a scaffold or to raise the level of the scaffold platform.

(2) Only a single tier of trestles shall be employed on scaffold platforms.

(3) The planks of scaffold platforms shall fit closely together, shall overlap and shall be firmly secured so as to prevent them from rocking or tipping. Projecting nails shall be removed."

(D. 23.5.1935.)

SWITZERLAND

Geneva

"23. All fixed scaffolding shall be provided with an outside barrier at least 1 m. high, consisting of two rails and a guard-plank or toe-board 15 cm. high, supported by uprights not more than 1.5 m. apart. The uprights shall be placed outside the rails and be strongly braced.

The wood used for such guard-rails shall have a cross section not less than 24 sq. cm. (deals 3×8 cm. or their equivalent). The use of rope as a barrier shall be prohibited. Guard-rails for suspended scaffolding shall comply with the provisions of section 60.¹

¹ See under § 2 (e) "Suspended Scaffolds".

27. Scaffold flooring shall be close-planked. The planks and boards shall be so laid as to avoid any overhang.

29. The thickness of scaffold boards shall be in proportion to the load and the span. They shall be bound with iron at the ends and shall overlap at least 40 cm."

(R. 25.3.1930.)

CZECHOSLOVAKIA

"(3) Every scaffold more than 1.90 m. high shall be provided on its outer side with a complete fencing of planks, or at least with a guard-rail 1 m. to 1.2 m. high. A board 25-30 cm. (toeboard) shall be permanently fixed on the edge of the scaffold floor, so that persons, materials, tools, etc., cannot fall off. This fencing or guard-rail shall be fastened to the standards, poles, etc., on the inside."

(O. 26.3.1931, sec. 21.)

UNION OF SOVIET SOCIALIST REPUBLICS

"(81)

Working platforms shall not be fixed to insecure parts of a building (railings, gutters, etc.).

86. Working platforms shall consist of planks not less than 5 cm. thick placed side by side without a space between them. The ends of the planks shall rest on the putlogs. The ends of one set of planks shall cover the ends of the next set above the putlog. At points where persons regularly pass or loads are regularly carried, the planks of the platform shall, if necessary, be nailed in position.

Intermediate platforms resting on barrels or on light scaffolds shall not be more than one storey high; the planks shall not rest on bricks or be so placed that the ends overhang the supports.

If no planks at least 5 cm. thick are available for platforms, the planking may be thinner, provided that the platform remains perfectly safe for the workers who use it.

87. There shall be no unprotected opening in the platform planking. The planking shall be touching the wall of the building. Any openings made in the planks near the walls to facilitate the work of erection shall be as small as possible and be closed as the work proceeds.

88. When in use, all scaffolds shall be fitted with a strong guard-rail at a height of not less than 1 m., and with a toe-board not less than 18 cm. high"

(O. 5.5.1930.)

§ 5. — Ropes and Chains

(For special regulations concerning ropes for suspended scaffolds, see under § 2 (e) "Suspended Scaffolds".)

AUSTRIA

"17. In building operations, in addition to chains, only flexible ropes of hemp, cotton or wire shall be used.

The faultless quality and the carrying capacity of ropes and chains shall be verified from time to time by competent inspection. Defective chains and ropes shall be at once competently repaired, or if this cannot be done with adequate safety, they shall be changed.

Chains and ropes of inadequate carrying capacity shall not be used."

(O. 7.2.1907.)

UNITED STATES

Ohio

"Section 27. Fiber ropes used to support a human load shall be inspected under the supervision of the employer or his authorized agent before use and weekly thereafter. Visual inspection shall be made for abrasion, broken fibers, cuts, frayings or any other defects. Fiber ropes showing any of the above defects shall have the twist thrown out and examined for internal wear and abrasion. Fiber ropes found to have defects under such inspection and examination and fiber ropes which have been injured with acid shall be removed from such service.

Section 28. (Table giving the maximum stresses to which various types and sizes of cables, ropes and chains may be subjected.)

Section 29. Wire ropes or cables shall be inspected under the supervision of the employer or his authorized agent at the time of installation and once each month thereafter, when in use, and removed from hoisting or load carrying service when any one of the following conditions exist:

- (a) When three (3) broken wires are found in one lay of 6×7 wire rope;
- (b) When six (6) broken wires are found in one lay of 6×19 wire rope;
- (c) When nine (9) broken wires are found in one lay of 6×37 wire rope;
- (d) When eight (8) broken wires are found in one lay of 8×19 wire rope;
- (e) When marked corrosion appears;
- (f) Wire rope which has been idle for three (3) months or more and subjected to water, moisture, dampness, etc., shall be cut off and inspected for internal corrosion, and if marked corrosion is found it shall be removed from hoisting or load carrying service;
- (g) When wire rope is used and not mentioned herein, it shall be inspected as above provided, when in use, and shall be removed from load carrying service when four (4) per cent. of the total number of wires composing such rope are found to be broken.

Section 30. Wire ropes or cables removed from service under the requirements in items (a) to (e) inclusive of Section 29 may be used for other purposes, but never to support a human load.

Section 31. The ratio between the rope diameter and the block, sheave or pulley tread diameter shall be such as to allow the rope strands to slide past each other and adjust themselves to the bend. The economical and absolute critical sheave diameters for steel ropes to be considered for any operating rope are shown in the following table. The "economical minimum" sheave diameters should be used for all operating hoist ropes. In no case shall the sheave diameter be less than the "absolute critical" sheave diameter for any operating ropes as specified below. For cable sizes not mentioned herein, see Manufacturers' Specifications for corresponding block, sheave and pulley diameters:

ECONOMICAL AND CRITICAL SHEAVE DIAMETERS FOR ROPES

	6×7	6×19	6×37	8×19
"Economical Minimum" Diameter for operating hoist ropes	36 D	24 D	16 D	20 D
"Absolute Critical" Diameter for any rope	28 D	16 D	14 D	14 D

Notes. — (1) D = Tread diameter of sheaves.

(2) Sheaves or pulleys with eccentric bores or with cracked hubs, spokes or flanges shall be removed from service.

Section 32. All connections, fittings, fastenings, parts, etc., used in connection with ropes, cables or chains shall be of such quality and strength and so attached, connected, fastened, etc., as to provide a safety factor of not less than four (4). Manufacturers' standard connections should be used wherever practicable.

Section 33. All running lines of hoisting equipment, located within six (6) feet six (6) inches of the ground or working level, shall be boxed, railed off or otherwise guarded, or the operating area restricted, except when loads are moved horizontally.

Section 34. Where practicable, all sheaves, blocks or pulleys in which wire cable is being used, and accessible to workmen, shall be guarded in such a manner as to prevent workmen's clothing or limbs being drawn into sheaves, blocks or pulleys.

Section 35. The use of single strand slip noose slings is prohibited. Fiber rope slings shall not be used for handling known acid-contaminated material or objects.

Section 36. All slings shall be of a kind necessary to carry the maximum working loads to be imposed upon them and effectively to prevent the slipping or tipping of such loads. Bridle slings shall be used on all horizontal loads over twelve (12) feet in length when composed of two or more pieces of material. A spreader shall be used when there is danger of the hitches slipping together.

Section 37. Slings that are found to be defective shall be destroyed.

Section 38. Where any rope or cable supporting any scaffold, structure or equipment is brought over a sharp corner of steel, stone or other material liable to cut or cause undue abrasion to the rope or cable, it shall be protected at such points by the use of bagging, wooden blocks or other protective padding."

(S.R. March 1931.)

Pennsylvania

"Rule 21. (a) Cables for scaffolds and hoists shall be not less than one-fourth ($\frac{1}{4}$) inch in diameter, and shall possess a factor of safety of at least eight (8). A metal tag shall be placed on all cables, at a point readily accessible to inspection, showing the size and material of the cable, including the maximum safe load, and the date of renewal.

(b) The fastenings of all cables shall be of an approved type. Particular care shall be taken in the pouring of sockets, and the metal used shall be zinc. Where thimbles and clamps are used the fastenings shall be made under the supervision of a competent man and not less than three approved clamps or clips shall be used at each fastening. Clamps shall be installed with the U bolt on the dead end of the cable. The splicing of cables is prohibited.

(c) Cables shall at all times be maintained in a perfectly safe operating condition and frequent inspections shall be made.

(d) Where "riding" of the cable on the drum occurs, it shall be adjusted immediately but the adjustment shall only be done by someone thoroughly familiar with the machine and experienced in such work.

(e) Ropes used for sustaining weight shall be of manila at least three-fourths ($\frac{3}{4}$) inch in diameter, of ascertained soundness and shall possess a factor of safety of at least (10) ten. A metal tag shall be placed on all ropes, at a point readily accessible to inspection, showing the size and material of the rope, including the factor of safety, and the date of renewal.

(f) Rope shall be at least double lashed at each point of suspension. Where supporting ropes are brought over sharp corners or subjected in any way to abrasion, they shall be protected at such points by bagging or rounded wooden blocking. Splicing anywhere throughout the length of rope is prohibited.

(g) Rope knots shall have their free ends lashed to the standing part so as to prevent their becoming untied. All knots shall be tested and made secure before the rope is used.

(h) Block and tackle shall fit the size of rope they carry and shall be so constructed that they do not chafe or abrade the ropes running through them.

(i) All ropes, slings and tackle shall be thoroughly and frequently inspected. When not in use, they shall be stored in a dry place.

(j) Wherever any solution containing acid, caustic or any other substance injurious to hemp rope fibre or iron or steel cables is to be used to clean buildings or other structures, the hangers and falls of the scaffold shall be protected to a height of at least six (6) feet above the platform with acid resisting material, and further provided that the ropes or cables shall hang over the outside edge of the scaffold platform. Solutions containing acid or caustic shall not be stored in the same room with scaffolding equipment."

(R. 1933.)

Wisconsin

"Order 3532. Rope.

1. *Fibre rope.* All fibre rope used for hoisting purposes or for the support of scaffolds, or any part thereof, shall be of high grade manila hemp (abaca). All fibre rope used for the support of scaffolds, or any part thereof, except rope used for lashing and tying purposes, shall be not less than $\frac{3}{4}$ inch in diameter.

The maximum safe working load for fibre rope shall not exceed $\frac{1}{6}$ of the maximum strength (breaking load).

When not in use, fibre rope shall be kept stored in a place, protected from weathering, which is dry and free from any deteriorating atmosphere or damaging agents.

2. *Wire rope.* The maximum safe working load for all wire rope used for hoisting purposes or for the support of scaffolds shall not exceed $\frac{1}{6}$ of the breaking load as determined by the manufacturer.

A wire rope is considered unsafe and shall be renewed when through broken wires, wear, rust, undue strain, or other cause the strength of the rope becomes reduced 25 per cent.

Note. — Wire rope should be considered unsafe when upon inspection in a length equal to 8 diameters of the rope 10 per cent or more of the total number of wires are broken.

Wire rope used for hoisting purposes shall be kept lubricated.

3. *Use of fibre and wire rope.* Where the bearing for any rope fastening has a diameter less than two times the diameter of such rope, the loop passing around such anchorage shall be lined with an approved metal thimble to prevent chafing or abrading of the rope at the bearing.

All fibre rope fastenings shall be by means of knots in which the free end will not have a tendency to slip. The free end of all knots shall be served to prevent untwisting and loosening of the fibres.

Wire rope fastenings for all work within the scope of this code, other than in connection with elevators, shall be as required for hoists under Order 3529. In addition, wire rope fastenings shall conform to good practice and the recommendations of responsible manufacturers.

Note. — For wire rope fastenings for elevators see the Elevator Code issued by the Industrial Commission.

Where any rope comes in contact with a rough surface or edge, protection, such as smoothly rounded wood or equivalent frictionless guard, shall be provided at such point of contact to prevent injury to the rope.

Every moving rope subject to load strain shall be maintained straight, without bends or turns, except at points where proper pulleys or sheaves are provided to accomplish the change in direction.

Where acid is used in the vicinity of fibre rope supporting a scaffold, such rope shall be protected against the deteriorating action of the acid by shielding with acid resisting material. Fibre rope that has been exposed to acid shall be tested each day before being used, and such rope shall not be used for any purpose except in connection with work that requires exposure to acid. Fibre

rope that has been damaged by acid shall not be used on any work which comes within the scope of this code."

(G.O. 15.7.1933.)

LUXEMBURG

"15. Hemp and wire ropes and chains shall be tested regularly at as frequent intervals as possible in respect of their condition and maximum permissible load, and if necessary shall be repaired or replaced immediately. During frosty weather in particular, precautions shall be taken in the use of hemp ropes."

(O. 28.8.1924.)

SWITZERLAND

Geneva

Fibre and Wire Ropes

"148. Fibre and wire ropes shall be replaced whenever their state of wear may impair their solidity. The administration may order resistance tests to be undertaken when doubts may arise as to the calibre, quality or state of preservation of fibre or wire ropes, and may require their replacement.

Fibre Ropes

149. Fibre ropes shall be dried before being stored. They shall be kept in a dry and airy place, without laying them directly on the ground, from which they shall be insulated by round bars or boards.

150. The contractor shall be bound to have his ropes tested at least once a year by a specialist firm which will give him a certificate as to the state of the ropes.

Every rope shall be sealed and numbered by the tester.

151. Every rope returned to the storeplace after the completion of a job shall be examined from end to end by a qualified man.

Special places, loops, and splices shall receive particular attention.

Defective parts shall be cut out. Bad lengths shall be cut in two to avoid any possibility of being mixed with the good lengths.

152. During transport by lorry and in storeplaces on the building under construction, ropes shall not be brought into contact with lime or cement.

In storeplaces, care shall be taken above all to avoid the corrosive action of hydrochloric acid and zinc chloride, both employed for welding.

153. In ordinary use no rope shall be under a load exceeding one-sixth of its tensile strength as indicated by the maker.

154. When a rope is wound round a winch, the winding diameter shall be at least eight times that of the rope if the winch is worked by hand, and thirty times that of the rope if the winch is worked by an engine.

155. Winch ropes shall be in one piece. The splice attachment of the hook shall be under constant supervision.

Wire Ropes

157. The installation of a new wire rope shall be preceded by an examination of the guide pulleys, pulley blocks and winding drum, which shall have smooth and regular surfaces. A new wire rope shall never be placed on pulleys with rough grooves.

158. Before being used the cable shall be greased with a neutral lubricant such as green vaseline.

Any lubricant or tar liable to harden shall be prohibited.

159. When a wire rope is wound on a winch the diameter of the winch drums shall be at least forty times that of the rope.

160. Every wire rope in use shall be tested at least once every three months. When the number of broken wires reaches 10 per cent. over a length of 2 m. the worn part shall be removed; if not the rope shall be replaced.

161. In ordinary use wire ropes shall not be subjected to a tensile stress exceeding one-sixth of the strength as indicated by the maker."

(R. 25.3.1930.)

CZECHOSLOVAKIA

Cables, Ropes and Chains

"45. (1) In constructional operations, in addition to chains only flexible cables of hemp, cotton or wire shall be used.

(2) The sound condition and safe working load of cables, ropes and chains shall be ascertained by expert examination before use on each occasion. Chains and ropes which are damaged or otherwise defective shall be repaired properly at once, or replaced if it is found impossible to repair them adequately.

(5) Special care shall be taken in lengthening and splicing wire ropes and fitting slings to ropes. Ropes shall not be joined merely by means of knots."

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

"37. Wire or textile ropes used in building operations shall have a tensile strength equal to not less than four times the maximum load permitted; they shall have been tested up to twice the maximum load by the manufacturer, who shall supply a certificate of strength and of testing with every rope delivered.

In addition, before being used every rope shall be subjected to a test at twice the maximum load and shall be inspected thereafter.

The test under the double load shall last for not less than 15 minutes.

Ropes with which no certificate of strength and of testing is supplied by the manufacturer shall be subjected to laboratory tests.

38. Ropes shall be regularly inspected and tested, in the manner described below, during the course of building operations:

- (a) Wire ropes shall be subjected to a tensile test and inspected thereafter once a month. They shall further be inspected weekly to determine the amount of wear; this shall be done by passing the rope through the hand, round which a rag shall be wound.
- (b) Textile ropes shall be subjected to a tensile test and examined thereafter once a week.

39. The testing and inspection of ropes shall be carried out by the person responsible for technical safety work on the building site, or by persons specially appointed by those in charge of the building operations.

40. Reports on the findings of rope inspections and tests and on any defects noted shall be entered in a special register immediately after each inspection, test or discovery of a defect."

(O. 5.5.1930.)

§ 6. — Protection of Floor and Scaffold Openings, Protective Roofs, and Similar Protection against Falls of Persons and Materials.

(a) GENERAL AND MISCELLANEOUS RULES

BELGIUM

"16. Effective measures shall be taken to prevent the falls of persons working in connection with the masonry, ceilings, woodwork, glass, iron work,

painting, erection of scaffolds, centerings, stays, assembling of machinery or appliances and in general, all work of construction, installation or assemblage.

The workers shall be protected, as far as possible, from the risk of being struck by any equipment or materials that may fall during such work.

Similar measures shall be taken to prevent any accidents that might occur during the demolition of buildings, the dismantling of scaffolds, the removal of centerings, stays or other appliances, and, in general, during all operations of demolition or dismantling."

(R.O. 31.3.1905.)

POLAND

"3 (1) The ground actually occupied by the works in progress shall be shut off by an enclosure from places accessible to the public. The enclosure shall be such as to avoid any risk that might arise from the fall of any objects whatsoever. Places on the building site that are accessible to the workers shall be protected in a similar manner"

(D. 23.5.1935.)

YUGOSLAVIA

"115. Persons underneath suspended scaffolds shall not be exposed to the danger of falling objects.

128. Spaces under scaffolding that is neither covered nor fenced in, or under windows, shall be protected against the fall of objects."

(R. 25.10.1921.)

(b) COVERING OF JOISTING AND FENCING OF FLOOR OPENINGS, ETC.

GERMANY

"70. (1) All joisting and girders that are not filled in with ceiling boards (laths, etc.) or with firm flooring immediately after they have been laid shall be closely covered over as soon as work is begun above them. While the ceilings of each storey are being filled in with concrete, vaulted or plastered, the cover shall only be removed as far as is necessary. The covers shall not be removed simultaneously from two consecutive sets of joisting or girders.

(2) All rooms, including staircases, that are not provided with joisting or girders shall be covered over at the height of the different storey ceilings. The topmost joisting or girders shall be closely covered over before work above them is begun.

(3) In structures or rooms without partition walls, pillars, chimneys, etc., complete covering over of the joisting or girders may be dispensed with; if covering is laid along the walls at least 2 m. wide and enclosed with handrails and toe-boards. In open halls, churches, etc., in this case a protective scaffold shall be erected under the workplace inside the building.

(4) Passageways and workplaces on joisting and girders shall be installed as scaffolds.

(5) Weak flooring, ceilings and vaulting, shall not be walked on or loaded.

(6) Ceiling boards shall be so laid that they do not break if accidentally walked upon."

(R. 1.1.1930.)

AUSTRALIA

New South Wales

"20. Where buildings exceed two storeys in height, immediately after the joists or girders are laid, a temporary covering of close boarding shall be laid on the joists or girders directly above where men are working.

Where pole or trestle scaffolding is erected from open floor joists or girders, the joists or girders must be temporarily close covered for a width of at least 5 ft. from the outside edge of scaffolding.

All well-holes or similar openings in floors must be effectively guarded."

(A. 26.11.1912, Second schedule, sec. 20.)

Queensland

"(iii) When any building is in the course of erection, repair, or structural alteration, it shall be the duty of the owner to make proper provision for the protection of workmen and others within the building, or in the vicinity thereof, by boarding over all well-holes, staircases, or lifts, or by fixing guard-rails down all the stairs and across all landings and well-holes, or by adopting such other means for that purpose as may be directed by an inspector, and by keeping such boarding and guard-rails in position as long as any risk of an accident would be incurred by the removal of such protection.

(v) While pole or trestle scaffolding remains erected from open floor joists or girders, such joists or girders shall be close covered for a distance of at least five feet from the outside edge of such scaffolding."

(R. 25.2.1916, sec. 16.)

Western Australia

Similar to *Queensland*.

AUSTRIA

"14. The scaffold openings required for the hoisting of materials to the various floors shall be provided with shaft-like hoarding between the stages of the scaffold, reaching to the lowest point of the hoisting plant, and, here as well as at the various stages, be open only at those places at which the material hoisted is from time to time loaded or unloaded. Similarly at the highest scaffold opening, only the place used for unloading the material hoisted shall be left unfenced.

30. To protect the workers against the risk of falling inside the building, either the ceiling joists (tie beams, cross beams) shall be completely covered over as soon as they are placed, or openings in the outside walls leading to the uncovered joisting, as well as those leading directly to court-yards, shafts and unfinished staircases, shall be securely fenced off.

When the stairs have been put in, until permanent handrails are placed temporary handrails shall be provided."

(O. 7.2.1907.)

UNITED STATES

California

"Order 1138. (a) All floor openings within a building or other structure during the course of construction, alteration, repairing or wrecking, shall be covered with planks so as to carry safely any load which may be required to be supported thereon, or fenced in on all sides by a barrier not less than three feet six inches (3' 6") high, except on those sides which may be used for the handling of materials hoisted through such openings, or at which stairs or

ladders land, provided that such sides other than landings shall be guarded by portable railings not less than three feet six inches (3' 6") high and shall have a toeboard at least six (6) inches high.

(b) If any runway or scaffold is built across any floor opening, the entire opening shall be completely planked over or otherwise the said runway or scaffold shall be provided with a railing at least three feet six inches (3' 6") high and shall have a toeboard at least six (6) inches high.

(c) All planks, railings or barriers guarding floor openings shall be left in place until such openings are permanently protected.

(d) Every scaffold or runway adjoining a floor opening shall have a railing at least three feet six inches (3' 6") high and a toeboard at least six (6) inches high on the side next to the opening."

(S.O. 1.7.1926.)

Wisconsin

"Order 3522. *Protection of openings in floors.* Every opening in a floor, whether such floor is temporary or permanent, shall be enclosed with a temporary guard railing (Order 3503¹) and a temporary toeboard (Order 3504¹). Such railing and toeboard shall be constructed as soon as possible after the floor (other than falsework) around the opening is put in place and shall be left in place until the permanent enclosure is installed.

The need for guarding a floor opening as above can be avoided only by closing the opening by means of solid floor construction as required for scaffold platforms under Order 3513¹. Such cover shall be fastened in place, or cleated to fit the opening, to prevent shifting.

Every runway or scaffold adjoining a floor opening shall have a temporary guard railing (Order 3503¹) and a temporary toeboard (Order 3504¹) on the side next to the opening. Where a runway or scaffold is built across any floor opening, the entire opening shall be completely planked over, unless all open sides of such runway or scaffold are protected with a solid enclosure not less than 3 ft. in height.

Every court bounded on more than two sides by permanent construction, and whose minimum dimension is less than 20 ft., shall be considered a floor opening."

(G.O. 15.7.1933.)

FINLAND

"27. In work on interior scaffolding erected on joists, the joists below the scaffolding and for not less than 2 m. beyond it on its outer sides shall be covered with strong scaffolding planks. The same precautions shall be taken in case of work on the fixing of windows and window frames.

Staircase and lift wells and other openings, hollows and similar places into which workers are liable to fall shall be provided with suitable covers or fenced."

(Res. 15.11.1927.)

FRANCE

"48.

The openings of liftways shall be fenced.

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50. In addition to the fencing provided for in section 66 *a* of Book II of the Labour Code, a toe board at least 15 cm. high shall be placed round openings in floors or scaffolds.

51. Framework on which employees work shall be boarded over to sufficient width to enable the employees to do their work in perfect safety. The width of this boarding, when supported on joists placed at the usual

¹ See under "§ 1 (c) Scaffold Materials and Construction".

spacing of 70 cm. for bricklayers' work shall be at least three metres. When the space between the joists exceeds 70 cm. such boarding shall be considered as a scaffold."

(D. 9.8.25/26.11.1934.)

GREAT BRITAIN

"30. Every opening left in a floor of a building or in a working platform for an elevator shaft or stairway, or for the hoisting of material, or for access by workmen, or for any other purpose, shall, until it becomes necessary to remove the fencing in order to complete the permanent enclosure be provided with a suitable guard rail and toe-board or with other efficient means to prevent the fall of persons or articles into the opening, except where and when access is required for workmen or for the movement of material."

(R. 21.6.1926.)

IRISH FREE STATE

As for *Great Britain*.

ITALY

"(8) Every opening, including those for the passage of materials or otherwise left for the necessities of building, shall be protected by suitable handrails or guards."

(R.D. 27.5.1900.)

LUXEMBURG

"17. In the case of new constructions or repairs, the cellars and the systems of binders and joists on or under which work is done shall be covered with a boarded floor of sufficient strength leaving no gaps. The covering of the uppermost floor shall not be removed until the roof is completed.

Cellars shall be covered in even if there is no system of binders and joists.

Openings leading into the open air or to uncovered rooms shall be securely closed with boards.

18. Until the stairs are built, the openings for them shall be fenced in with rails or covered with boards, and the same shall apply to wells for lifts.

Provisional hand-rails shall be placed on stairs which are already in position until the permanent banisters are fixed."

(O. 28.8.1924.)

NORWAY

"116. When the roof-truss is being erected, the top set of joists shall be entirely covered with planks, or else the greater part of it shall be covered by a scaffold platform."

(R. 6.10.1928.)

POLAND

"31. (1) When it is necessary to work above ceiling joisting on which the ceiling has not been laid, or which has not been fastened immediately after being laid, the joisting shall be provided with a temporary covering consisting of strong and closely laid planking the planks of which shall be sufficiently thick to ensure the safety of the workers.

(2) The planking shall not be used for the storage of building materials. If it is necessary to store building materials temporarily on the planking, the planking shall be reinforced in proportion to the anticipated load.

(3) The ceiling joists placed immediately below those covered by the

planking mentioned in sub-sections (1) and (2) above shall be provided with single planks at regular intervals not exceeding 0.07 m.

(4) The filling in of ceilings with concrete as well as their subsequent installation and final covering shall as a rule be done in the natural sequence, working from the lower to the upper storeys. Exceptions to this rule shall only be allowed if no question of safety is involved, and provided that when work is done above a ceiling carrying a temporary planking, the ceiling immediately below shall be covered with planks.

(5) Openings in walls leading to the outside of the building and openings in uncovered ceilings, skylights, light wells, etc., shall be closed by planks crossed diagonally when the lower edge of the opening is less than 0.50 m. above the level of the corresponding platform.

(6) The planking of the highest platform shall not be removed until the roofing has been completed."

(D. 23.5.1935.)

SWEDEN

"(a) At places where the workers are exposed to the risk of injury by falling or from falling objects, the necessary protective devices shall be provided, in so far as the nature of the work allows thereof, e.g., openings in the floor, scaffolding, platforms, hoists and the like shall be suitably fenced, and staircases shall be provided with handrails."

(A. 29.6.1912, sec. 4.)

SWITZERLAND

Geneva

"30. If workers are employed on superimposed scaffolds, special precautions shall be taken to protect those working underneath.

72. During the work, chimney holes, openings in light wells or ventilation shafts, or any other openings whatsoever in the floors shall be provided with a regulation barrier having a toe board at the bottom, or temporary boarding closely laid and firmly secured, covering the entire gap.

73. When the openings are used for hoists the barriers may be movable, but arranged so to be quickly replaceable after the hoist has been used.

74. During construction, lift shafts independent of staircases shall be completely boarded in at each storey. When the boarding has been removed the openings in the shafts at the landings shall be fenced.

77. Staircases in which the straight drop is more than 30 cm. wide shall be boarded in at all storeys unless the staircase is enclosed by boarding leaving no free space exceeding 20 cm. This measure shall not dispense with the necessity of placing the barriers provided for in the preceding section.¹

79. Stair landings formed by joisting shall be completely covered by closely laid planking.

93. All joisting shall be covered with a temporary floor immediately after it is laid."

(R. 25.3.1930.)

Zurich

"38. Openings for light wells, lift shafts, trap doors, etc., in the joisting . . . shall be fenced in or enclosed. Staircases shall be completely covered over in the same way as joisting. In lift shafts the door openings shall be fenced off with self closing enclosures.

¹ See under § 4 (b) "Temporary Stairs",

45. Every set of joists shall be boarded over immediately after being laid. If the false ceiling is not mortised in, timber joisting shall be closely laid with boards at least 24 mm. thick. In the case of abnormal clearance between joists scaffold planks shall be used for covering them. Joisting, joist covering, scaffold flooring and stairs shall always be kept clear of rubble and rubbish. Iron joisting, even if filled in with pugging, etc., shall be covered over with scaffold boards.

.....
The joisting on which work is being done shall be completely covered over with scaffold boards. The joisting underneath, and any joisting under other joisting that is heavily loaded with material shall be boarded over.

46. For the erection of the roof structure, the roof joists or collar beams shall be immediately boarded over by the carpenter. The boarding shall remain in place until the completion of the carpenters', roofers', tinsmiths' and painters' work, unless the false ceiling is laid meanwhile."

(R. 31.1.1931.)

CZECHOSLOVAKIA

" 4 (h) *Openings in scaffolds*

38. All openings in scaffolds and in flooring of every kind, e.g., openings for partitions, future permanent lift shafts, conduits of every kind, lighting shafts and similar installations shall be safely covered or completely surrounded by a guard-rail and toe-board. Openings for the temporary conveyance of materials, e.g., chutes, openings for transporting joists, etc., shall be safely covered as soon as they cease to be used. Fencing which has been removed shall be secured in place afresh.

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10. *Precautions to be taken inside buildings*

58. (1) So long as joists and girders are being laid or uncovered, work shall not be carried on below them unless a reliable protective roof has been erected.

(2) Ceilings and the like shall be covered immediately after the joists are laid, by the fixing of the false ceiling, vaulting, etc., or the ceiling girders (traverses, beams, etc.) immediately after being laid shall be given a provisional but complete covering of closely-laid squared planks not less than 2.5 centimetres thick, or, finally, the openings leading to uncovered beam courses shall be securely fenced. Further, openings leading to open spaces, lighting shafts, uncompleted staircase wells and cellars, and openings in ceilings, in particular for stairways, ladders, lifts, etc., shall be fenced.

(3) Stairways already erected shall be provided with strong temporary guard-rails pending the fitting of the permanent rails. The other stairways shall also be safeguarded on their open side by strong guard-rails. The same rule shall apply to the various slopes, corridors, balconies, terraces, etc., in so far as access thereto is not safely blocked.

(4) Means of communication (passageways, stairs) and workplaces in unroofed rooms shall be provided with safe shelters, roofing or scaffolding to protect them from falling persons or objects.

(5) In the erection of the iron framework of a building, work shall not be carried on below places where iron parts of the structure are being transported, hoisted and assembled.

(6) If materials are to be transported or stored on the false ceiling, it shall be constructed of sufficiently strong planking, or a special layer of joists shall be built over it."

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

" 83. When stone buildings are erected without external scaffolding, suitable guards shall be fixed over door and window openings, as the building advances, to prevent persons from falling through these openings.

.....

" 109. When the temporary planking resting on the joists is used as a support for working platforms in place of scaffolds, it shall consist of planks not less than 4.5 cm. thick, forming an unbroken surface, with no openings over the whole length of the platform. The part not covered by the planking shall be fenced off by guard-rails not less than 1 m. high and solid toe-boards not less than 18 cm. high.

Note. — If no planks at least 4.5 cm. thick are available, thinner planks may be used, provided that the resulting planking offers every guarantee of solidity.

110. In order to prevent the planks from shifting or turning over, the ends shall rest on or be placed over supports and covered by a higher row of planks. When there is a risk of the planks of the higher row moving out of place, they shall be nailed to the lower row.

111. No large quantity of materials shall be dumped at any point on the planking without permission from the technical staff in charge of the work. Loads shall not be placed on the parts of the wooden ceiling (case-bay) between the beams.

112. When planking has to be placed on the joisting of the ceiling for the passage of persons or the transport of loads, the said planking shall be protected by guard-rails 1 m. high with a toe-board at the foot not less than 18 cm. high. Under no circumstances shall laths or the ceiling fittings or unfinished wooden ceiling parts (case-bays) be used for this purpose.

113. When part or the whole of the unbroken temporary planking is removed, access to the room from which it has been removed shall be completely closed by appropriate guards, unless passages have been arranged in accordance with the provisions of the preceding section.

114. On all passages used by persons or for the transport of loads, the openings in the floor of each storey, in vaults or roofs, openings for staircases, dormer windows, lift wells, etc., shall be entirely covered by boards or fenced in with a strong guard-rail of not less than 1 m. in height with a toe-board at the foot not less than 18 cm. high.

115. Door openings and other similar lateral openings leading to places with no planking or to the outside of the building shall, if they are at some height, be suitably guarded or entirely blocked by nailed boards."

(O. 5.5.1930.)

URUGUAY

" XVII. Scaffold openings for ladders shall be covered over provisionally until the ladders are placed in position."

(D. 14.4.1915.)

YUGOSLAVIA

" 128. Joists shall be covered with planks as soon as they have been laid, and wall openings shall also be so covered, so as to prevent workers from falling when inside the building.

A provisional guard-rail shall be erected at once round permanent landings. Spaces under scaffolding that is neither covered nor fenced in, or under windows, shall be protected against the fall of objects."

(R. 25.10.1921.)

(c) CATCH SCAFFOLDS AND PROTECTIVE ROOFS

GERMANY

" 47. (1) Protective scaffolding or protective roofing shall be so installed that workers or objects cannot fall off or through it. It shall not be used for the execution of work, for the storage of building materials, or as a passage-way.

(2) The protective roofing must be sufficiently wide, slope towards the building or the wall to be scaffolded, and be provided at the outside edge with a sufficiently high fender board. Only squared boards of adequate thickness shall be used as covering.

(3) Where protective scaffolds cannot be used the insured persons, and persons working or passing underneath, shall be protected against falling objects by other means, e.g. nets, sheets.

(4) With pole scaffolds on which work is done and loads are placed, when the workplace is 5 m. or more above the ground level, the stage immediately underneath shall also be completely covered over.

(5) The vertical distance between any two scaffold stages shall not as a rule exceed 2 m."

(R. 1.1.1930.)

AUSTRIA

" 30.

Means of communication (gangways, stairs) under uncovered rooms shall be roofed over as a protection against falling objects."

(O. 7.2.1907.)

UNITED STATES

California

" *Order 1133.* (a) Where it is impracticable to provide temporary floors on structures as required in these orders, rope nets shall be suspended below points where men are working, or safety belts shall be used on such structures as theaters, auditoriums, towers, bridges, etc.

(b) The nets shall be made of at least one-half ($\frac{1}{2}$) inch diameter manila rope with three-quarter ($\frac{3}{4}$) inch diameter borders and four by four (4×4) inch mesh. The borders of the nets shall be provided with loops so that they can be readily combined or attached to convenient points on the structural frame."

(S.O. 1.7. 1926.)

Ohio

For life nets see under § 7 (b) "Safety Belts and Life Lines".

Overhead Protection

"Section 254. Overhead protection shall be provided by means of lumber or other material of strength and construction reasonably adequate to catch, deflect or hold any reasonable weight of material or objects that may fall upon such protective construction. Such overhead protection shall not be required in private residence construction less than four (4) storeys in height unless special hazards exist or develop in the course of such construction.

Section 255. Where employees are working below other employees on floor levels with open floors above; in large auditoriums or similar large apartments or rooms; and on operations on the outside of buildings or structures, overhead protection shall be provided. Areas where there is danger of falling objects from above shall be railed off or otherwise guarded unless overhead protection is furnished. This shall not apply to operations carried on in an ordinary enclosed room, nor to areas over which loads are swung by derricks, cranes or other similar equipment.

Underfoot Protection

Section 256. Protection in the form of temporary floors or platforms, shall be provided for all workmen where they are required to work over machinery in operation, open vats containing dangerous fluid, furnaces when in use, railroad tracks with moving equipment below the work, high tension electric

wires unless killed and properly grounded or similar sources of danger. Where it is impracticable to furnish temporary floors or platforms for the hazards above mentioned, safety belts or life nets shall be provided and used if at all possible."

(S.R. March 1931.)

Pennsylvania

"Rule 23. (a) Where a scaffold is erected over or near a space, traversible by workmen or the public, protection shall be provided underneath the scaffold. Such protection shall consist of a suitable catch platform well supported and without openings in the flooring or some other equally effective means of overhead protection. This platform shall be strong enough to afford protection not only to those below, but also to the workmen above in case of a fall. Where such platform extends from a building it shall slope toward the building and be flush with the wall.

(b) In operations where considerable material is handled on the scaffold, the outer edge of the catch platform shall be provided with a fence or wire screen to prevent fallen objects from rebounding over the edge.

(c) Where workmen are working above other workmen or where there is a likelihood of objects falling from above, the latter workmen shall be protected by plank, wire or expanded metal shields strong enough to catch and retain any weight liable to fall from above. Such overhead protection shall be located not more than ten (10) feet above the platform or working floor. If wire mesh or expanded metal is used the openings shall be not greater than one-half ($\frac{1}{2}$) inch and the construction shall be not less than No. 10 steel wire gauge for wire and No. 13 U.S. gauge for expanded metal.

(d) Where two or more separate scaffolds are used simultaneously one above the other, overhead protection similar to that required in paragraph (c) shall be provided for the men on the lower scaffolds in addition to the catch platform."

(R. 1933.)

Wisconsin

"Order 3527.

2. *Floors in buildings other than steel frame.* On all buildings which do not have a steel framework which is built independent of walls and floors, the floor, or one layer thereof in the case of a wood floor, shall be completed not more than two stories below the highest masons' scaffold.

Note. — If the architect does not wish the permanent floor to be so laid, he should specify how and by whom the floor required under this paragraph shall be provided.

Order 3533. *Protection from falling objects.* Every hoisting engine, air compressor, concrete mixer or other machine used in construction work and which requires an attendant, shall be covered over to protect the operatives stationed at the machine, except where the horizontal distance from such machine to the nearest point where work is being done is at least one-half the vertical height of such point above the machine. The covering shall be solid, shall extend not less than 4 ft. outside the normal working area of the attendants at the machine, and shall be constructed to support a uniform load (in addition to the weight of the covering) of not less than 30 lbs. per square foot over the entire cover or roof.

When elevator constructors or others are working in an elevator shaft, or on the shaftway enclosure, no material, tools or objects other than those needed by such workmen shall be hoisted or lowered in such shafts.

Workmen of more than one craft or doing different classes of work or working at different levels shall not be permitted in a shaftway at the same time unless a temporary floor protection as described in Order 3520¹ is provided between all upper and lower workmen or groups of workmen.

¹ See under § 4 (c) "Working Platforms: General Rules".

When men are working in a shaftway, all material and objects on upper floors shall be kept not less than 6 ft. from the shaftway, except on the sides where a solid enclosure is provided.

If two or more elevators are located in the same shaftway and one elevator is put into temporary service before the others are completed, then the elevator in use (together with its counter-weights) shall be separated from the other elevators by a continuous partition. This partition shall either be solid or consist of a screen of not less than No. 13 U.S. standard gauge wire with 1 in. mesh."

(G.O. 15.7.1933.)

FINLAND

"28. Work liable to give rise to accidents through the falling of objects shall not be carried on above any place where workers must pass or are employed, unless suitable precautions are taken.

There shall not be sufficient space between the planks of a gangway or run or scaffold stage for any object to slip through or for a worker accidentally to put his foot through.

All places on scaffolding where bricks are dumped shall be solid and strongly built.

A solid and sufficiently wide and strong safety roof shall be placed above every door opening not shut off or other place where workers must pass or are employed, in order to protect them from objects falling from above."

(Res. 15.11.1927.)

GREAT BRITAIN

"31. Any part of the premises in which any person is habitually employed shall be covered in such a manner as to protect any person who is working in that part from being struck by any falling material or article."

(R. 21.6.1926.)

IRISH FREE STATE

As for Great Britain.

ITALY

"9.
Every stair case shall be covered over by scaffolding at the height of the first storey floor to protect any workers who may pass on the ground floor."

(R.D. 27.5.1900.)

NETHERLANDS

"23. At a distance of not more than 2 m. below any scaffold over 4 m. above the ground level that is used for the transport or stacking of materials shall be fitted another completely solid platform of the same width to catch any falling objects. This rule shall not apply if the platform rests on the joists.

Without prejudice to the provisions of the preceding paragraph, there shall be a complete, solid platform at intervals of not more than 10 m. on all scaffolding exceeding 15 m. in height; these platforms shall remain in position until the scaffolding is demolished.

If the gable of a building is not constructed at the same time as the interior, and if the scaffold platform is to be used solely as a gang-plank or for the transport of materials, the safety scaffolding may be fitted on the highest set of joists below the platform, provided always that the distance between them is not more than 4 m.

24. An adequate protective screen at an inclination of 45° shall be fitted along the scaffolding at entrances to the building and at points where work is going on beside the scaffold or where there is steady traffic along the scaffold,

if there is a platform at a height of more than 4 m. and a danger of persons being struck by falling objects.

The protective screen shall be fixed not more than 3 m. above the said danger points and shall project not less than 0.75 m. beyond the platform from which objects may fall. It shall consist of boards not less than 2 cm. thick and be securely attached and supported.

In addition to the protective screen, an effective covering shall be placed over entrances and at any other necessary spots. A solid hoarding shall also be erected along scaffolding where there is a regular stream of traffic."

(R. 1934.)

SWITZERLAND

Zurich

" 35. Places where plaster or concrete is prepared, unless they are at least 7 m. distant from the plasterers' or building scaffold, shall be protected by a strong roof. Similarly the lower workplaces on frontages shall be protected against the fall of materials. In particular, the lowest scaffold platform shall always be covered close up to the frontage to protect the workers and the public."

(31.1.1931.)

CZECHOSLOVAKIA

" 22.

(2) Bricklaying from the inside of buildings (overhand) shall only be allowed in the erection of one-storey buildings. In the case of higher buildings, overhand bricklaying shall be allowed only by way of exception, in cases where there are valid reasons (legal or technical conditions, traffic, etc.) against erecting a proper general scaffolding. In this case, the wall shall be carried as a rule to six layers of bricks above the floor of the inside scaffolding from which the bricks are being laid overhand; and at this level at least a protective cantilever scaffold, not less than 1.5 metres wide and securely enclosed by a toeboard and guard rail, shall be erected to catch falling materials or workers. As the work proceeds this scaffolding shall be constantly re-erected at the level of the floor next below the working platform.

(3) If general scaffolding cannot be erected during the assembling of the iron framework of a building, protective scaffolding shall be erected as the work proceeds.

58.

(4) Means of communication (passageways, stairs) and workplaces in unroofed rooms shall be provided with safe shelters, roofing or scaffolding to protect them from falling persons or objects."

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

" 82. When stone buildings are erected without the use of external scaffolding, a wooden shelter shall be erected in place of the scaffolding, in accordance with the following rules:

(a) The shelters shall be erected externally, along the whole length of walls in course of erection and at every second storey. The lowest shelter shall not be higher than the window ledge of the second floor. The shelters shall be permanent—i.e., they shall remain in position until the erection of the walls is completed. From the window ledge of the fourth floor upwards, the shelters may be removable—i.e., those from the fourth floor may be transferred to the window ledge of the sixth floor, and so on.

(b) The shelters shall be not less than 1.5 m. wide and shall slope slightly upwards (about 20°).

(c) The shelters shall be sufficiently strong to bear the weight of a person falling accidentally off the wall.

(d) The shelters shall not be used for persons passing or for dumping building materials or any other objects.

92. In order to prevent the fall of building materials, light wooden coverings shall be laid on the putlogs above transport lines or passage ways. These coverings shall not be used as gangways by the workers or for dumping materials. The coverings shall be not less than 2 m. wide in the case of buildings not exceeding four storeys, and 3 m. in the case of higher buildings. They shall slope towards the wall and shall have a parapet of planks not less than 18 cm. high."

(O. 5.5.1930.)

URUGUAY

"XIII. The platform immediately below one on which work is being carried on shall not be removed."

(D. 14.4.1915, sec. XIII.)

"I. In constructional work with reinforced concrete as a basis, wire netting not less than 3 m. wide shall be placed round the front of the building and beneath the floor under construction as a protective and safety device.

The said netting shall be stretched over beams with a section of $7\frac{1}{2} \times 7\frac{1}{2}$ cm. and placed at an average distance of 3 m. from each other, with an inward slope of 30 degrees."

(D. 4.1.1928.)

"5. All openings in the frontage or frontages of constructions in reinforced concrete shall be provided with two stout rails 0.25×0.10 m., placed, the first 0.70 m. above the floor, and the second 0.70 m. above the first.

6. When inside work is being done near the said openings and at a height of more than 0.70 m., the openings shall be protected over their entire surface by rails placed at intervals of 0.70 m."

(D. 18.10.1929.)

(d) TEMPORARY FLOORS IN STEEL-FRAMED AND SIMILAR BUILDINGS

CANADA

Alberta

"7. (1) Where the plans and specifications require the floors to be arched between the beams thereof, or where the floors or filling in between the floors are of fireproof material the flooring or filling in shall be completed as the building or excavation progresses to not less than within three storeys below that on which the iron work is being erected.

(2) Where the plans and specifications do not require filling in between the beams of floors with fireproof material or brick work, the contractor for the carpenter work, in the course of construction, shall lay the under flooring of the building on each storey as the building or excavation progresses to not less than within two storeys below the one to which the building has been erected.

(3) Where double floors are not to be used, such contractor shall keep planked over, with planks properly secured, the floor two storeys below where the work is being performed.

(4) If the floor beams are of iron or steel, the contractor for the iron or steel work of a building or excavation in course of construction, or the owner of such a building or excavation, shall thoroughly plank over the entire tier of iron or steel beams on which the structural iron or steel work is being erected,

except such spaces as may be reasonably required for the proper construction of such iron or steel work and for the raising or lowering of materials to be used in the construction of such building and such spaces as may be designated by the plans and specifications for stairways and elevator shafts.

8. In the case of what are known as skeleton steel frame buildings, compliance with the following regulations shall be sufficient, and it shall not be necessary to comply with the requirements of the next preceding section:

(a) As soon as the steel frame of a building is erected to the first column splice above the first floor level, a flooring of 2 in. planking shall be laid over floor beams on the floor immediately below the first splice, making a temporary floor over that part of the area of the building or excavation inside columns at that level, except in places where it is necessary to have openings for the passage of material for building above that point; and when erection has reached a point level with the next column splice the planking used as a temporary floor at first column splice shall be removed and placed as before at second splice, and so on to the top of the building;

(b) A double flooring of 2 in. planking shall be laid down immediately under any derrick for a sufficient space about the derrick to protect workmen on the floors below that on which the derrick is working and to hold with safety the materials hoisted by the derrick;

(c) Riveters' staging shall be so constructed as to secure the reasonable safety of the riveters and a temporary floor must be provided on the girders and floor beams immediately below the portion of the floor upon which the riveters are working, sufficient for the protection of workmen engaged below that floor;"

(Revised Statutes 1922, Chap. 193.)

Manitoba	}	Similar to <i>Alberta</i> .
Ontario		
Saskatchewan		

UNITED STATES

California

"Section 1. Any building more than two storeys high in the course of construction shall have the joists, beams or girders of floors below the floor or level where any work is being done, or about to be done, covered with flooring laid close together, or with such other suitable material as will protect workmen engaged in such building from falling through joists or girders, and from falling planks, bricks, rivets, tools, or any other substance, whereby life and limb are endangered, as follows:

(a) Any such building which is of reinforced concrete construction, with reinforced concrete floors, shall have the floor filled in either with forms or concrete on each floor before the commencement of work upon the walls of the second floor above, or the commencement of work upon the floor of the next floor above. Any building having wooden floors, other than a steel frame building shall have the underflooring, if double flooring is to be used, laid on each floor within the time hereinabove described for reinforced concrete floors. Where single wooden floors are to be used, each floor shall be planked over within the time hereinbefore prescribed.

(b) If such building has a structural frame of iron or steel, the entire floor of every second storey, except such space as may reasonably be required for the proper construction of such building, shall be thoroughly covered with planks tightly laid together, so that workmen shall have at all times planked floors within two storeys below them.

(c) If a span of a floor exceeds thirteen (13) ft., an intermediate beam shall be used to support the temporary flooring; provided, however, that spans not to exceed sixteen (16) ft. may be covered by three (3) in. planks without such beam. Such intermediate beam shall be of a sufficient strength to sustain a live load of fifty (50) pounds per square foot of the area supported.

(d) If the distance between planked floors in any building or structure exceeds twenty-five (25) ft., intermediate flooring or safety nets shall be provided which shall be fixed not to exceed twenty-five (25) ft. below a floor upon which work is being performed and as close to such floor as practicable.

(e) The erection gang shall at all time have a planked floor below them not more than two storeys distant.

(f) The riveting gang and steel painters shall at all times have a planked floor below them not more than two storeys distant. Men working below riveting gangs shall at all times be protected from falling objects by having a planked floor between them and the riveting gangs.

(g) If building operations are suspended and the temporary flooring, hereinbefore required, is removed, upon the resumption of work, in case of such suspension, the building must be replanked so that every man at work shall have a covered floor not more than two floors below.

(h) Where a building is being constructed in sections each section shall constitute a building for the purpose of this Act.

(As amended by chap. 334, Stats. 1921.)

Section 2. Where such building has a structural frame of iron or steel, and the iron or steel columns are spliced at every storey, the erection gang shall in no case be more than two storeys distant from the riveting gang. If the columns are spliced every second or third storey, the erection gang shall in no case be more than four storeys distant from the riveting gang.

(As amended by chap. 334, Stats. 1921.)

Section 3. Planked floors shall consist of planks tightly laid together of No. 1 common lumber, not less than two inches thick and eight inches wide, free from protruding nails or other objects. Nets shall consist of at least one and one-half inch ¹ manila rope with three-quarter inch ² borders, and four by four inch mesh. The borders of the nets shall be provided with loops so that they can be readily combined or attached to convenient points on the structural frame."

(Chap. 107. Statutes 1909, as amended by Chap. 590, Statutes 1911, and by Chap. 334, Statutes 1921.)

Ohio

Temporary Floors

"Section 246. Temporary floors shall be provided in all structures for men working on various floor levels and shall be of sufficient strength to support a minimum, uniform load of twenty-five (25) lbs. per square foot in such manner that the allowable stresses given in tables,³ Section 23, are not exceeded. The floor boards or planks shall be placed as close together as possible, and shall not extend more than one (1) foot beyond supports unless securely fastened to prevent slipping or tipping. All planks shall project not less than four (4) inches beyond the inside face of the bearing unless securely fastened.

Section 247. When it is not necessary for employees to work over the entire area of a floor, only such partial area on which it will be necessary for men to work shall be provided with the temporary floors as required in Section 246 of this code. The temporary working floors shall be provided on the exposed sides with the standard guardrails and toeboards.

Section 248. All joists shall be securely fastened to prevent tipping before placing the temporary floors. Over joists upon which concrete floors are to be poured, expanded metal, metal lath or wire mesh, not greater than one-half ($\frac{1}{2}$) inch mesh, may be used where the joist spacing does not exceed twenty-four (24) inches, provided that all laps and joists are securely fastened and

¹ Circumference.

² Diameter.

³ Not reproduced.

that plank runways are provided for the safe passage or working thereon by employees.

Section 249. In buildings or structures where the upper floors are constructed before the lower floors, temporary floors of the strength provided in Section 246 shall be maintained not more than three floors below the floor being constructed.

Section 250. Structural steel frame buildings shall have temporary floors as provided in Section 246 placed within six (6) typical floors of the erectors and three (3) typical floors of the riveters. Such floors shall cover the entire floor area beneath riveters or erectors, except that no floors are required over hoistway or stairway openings. Safety belts or nets shall be provided and used where the construction does not permit the placing of the floors required above. The provisions of this section shall not apply to what is generally known as mill buildings, where no floors are contemplated, and where the operation of overhead cranes, etc., will not permit.

Section 251. Reinforced concrete frame constructed buildings shall have floor or concrete forms constructed before the forms of the storey above are started.

Section 252. In sectionally constructed buildings each section constitutes a separate building operation in the application of the temporary floor requirements of this code.

Section 253. The foregoing requirements relating to temporary floors shall not apply to the erection or construction of towers, stacks or scaffolds."

(S.R. March 1931.)

Pennsylvania

"Rule 18. (a) The first floor above the street floor shall be completely planked over as soon as practicable, leaving only such openings as are reasonably necessary and same shall thereafter be kept covered throughout the entire period of construction. This does not apply to buildings less than three (3) storeys in height.

(b) The working floor shall be completely planked over except openings that are reasonably necessary.

(c) A floor not more than three (3) storeys below the working floor shall be completely planked over, except openings that are necessary, and shall have guard rails and toe boards or other equivalent protection at all openings and outside edges, except that where this is impracticable, safety nets or catch platforms shall be provided. Such temporary floors shall not be removed until a permanent floor is laid.

(d) Temporary floors shall consist of sound commercial lumber at least two (2) inches in thickness, with spans not greater than eight (8) feet. Where the beams are more than eight (8) feet apart, temporary intermediate joists shall be provided of sufficient strength to carry a live load of at least fifty (50) pounds per square foot with a factor of safety of four (4). Planks shall extend at least one (1) foot past the support or shall be nailed or otherwise securely fastened. Planks shall have no unsupported projection greater than one (1) foot six (6) inches.

(e) All openings in floors, temporary or permanent, shall be enclosed by guard rails and toe boards. Such guard rails and toe boards shall be constructed as soon as the flooring around the openings is laid and shall be left in place until the operation is completed. Workmen are prohibited from working on any floor of a building unless all openings on such floor are closed by guard rails and toe boards. All unused openings in floors, temporary or permanent, shall be completely planked over until such time as they are used.

(f) Where it is impracticable to provide temporary floors, rope safety nets shall be substituted therefor. Such substitutions are applicable in special cases such as auditoriums, arch trusses in theatres, towers, bridges and similar construction work. Safety nets shall be made of manila rope at least one-half ($\frac{1}{2}$) inch in diameter and four by four (4×4) inches mesh, with a border rope at least one (1) inch in diameter. Where nets are composed of sections,

the borders of each section shall be provided with loops at suitable intervals so that the sections may be readily combined and attached to convenient points on the structural frame."

(R. 1933.)

Wisconsin

"Order 3526. *Temporary protective floors in steel erection required.*

1. *Temporary protective floors required.* During the erection of steel framework for structures, a temporary protective floor, completely planked over, shall be provided not more than 5 storeys, or 30 ft., below the highest level on which the steel erectors are working. In such structures more than 5 storeys in height, counting the basement as a storey, if the construction of permanent floors does not follow the steel erection within 3 storeys of the protective floor, then a second protective floor constructed as required for the first protective floor shall be placed below such work and not more than 3 storeys lower than the first protective floor.

2. *Construction of temporary protective floors.* All temporary protective floors shall be constructed of material as required for scaffolds under Order 3512.¹ The floor planks shall be not less than nominal 2 × 10 in., and the span shall not exceed 8 ft. If the permanent beams are spaced more than 8 ft. center to center, temporary intermediate beams or joists shall be provided of sufficient strength to carry a live load of 50 lbs. per square foot with a factor of safety of 2.

Planks shall extend not less than 1 ft. beyond the support, or shall be nailed or otherwise fastened to prevent slipping, but planks shall not cantilever more than fifteen times the thickness, nor more than one-tenth of the length, of such planks.

No openings shall be permitted in such protective floors, except such as may be reasonably required for the proper handling of materials, and for stairways and ladders. If it becomes necessary to remove any of the planks temporarily, they shall be immediately replaced.

See Order 3522² regarding need for guarding of floor openings.

See Order 3501³ regarding responsibility for provision of safeguards."

"Order 3527. *Progress in permanent floor construction.*

1. *Floors in steel frame buildings.* The permanent floor construction shall be kept within 4 storeys of the lowest temporary floor; or if this is not practicable, a protective floor shall be provided not more than 4 storeys above the permanent floor construction; but if the steel work has been completed and all loose material and other movable objects have been removed from overhead, then such protective floor shall not be required.

2. "

(G.O. 15.7.1933.)

SWITZERLAND

Geneva

"95. The placing of false-work for flooring in reinforced concrete on open joisting more than 4 m. in height shall be done from a temporary platform between the props.

96. The erection of metallic framework of all kinds, roofs, bridges, etc., shall not be undertaken without proper scaffolds."

(R. 25.3.1930.)

¹ See under § 4 (c) "Scaffold Materials and Construction."

² See under § 6 (b) "Covering of Joisting and Fencing of Floor Openings".

³ This Order reads as follows: "The responsibility for the provision and maintenance of the protection for a workman required under this Code rests with his immediate employer unless this responsibility is otherwise definitely assigned in the specifications or contract and properly executed by the assignee".

§ 7. — Roof Work and Similar Dangerous Work

(a) GENERAL AND MISCELLANEOUS REGULATIONS

GERMANY

" 77. Before beginning work in connection with or on roofs, including the boarding or lathing of roofs with a gutter height of more than 5 m. above the ground, the following safety precautions shall be taken:

(1) On roofs with a slope of less than 20°, if protective scaffolds are not installed, the insured persons employed on or near the edges of the roof shall be secured against falling by being roped;

(2) On roofs with a slope of more than 20°:

(a) A closely laid and adequately strong protective scaffold (catch scaffold) shall be constructed, the guard wall of which shall project at least 0.80 m. vertically beyond the gutter edge. The guard wall shall extend to at least 1 m. above the scaffold floor. The scaffold floor shall not lie more than 1 m. below the gutter edge;

(b) If pole scaffolds or ladder scaffolds are used they shall be erected as in paragraph (2) (a);

(c) In the case of multi-pitch roofs (mansard roofs), in addition, at every angle in the roof a catch scaffold as in paragraph (2) (a) shall be erected if the upper roof has a slope of more than 30°.

78 (1) If a boarded roof is steeper than 45° the insured persons shall be roped irrespective of the height of the gutter above the ground, unless the roof is enclosed in a regulation working scaffold. The regulation concerning protective scaffolds shall not thereby be affected.

(2) For work on lathed roofs roping shall not be required, if the lathing rests directly on rafters, the pitch of the roof does not exceed 60°, and a regulation protective scaffold is constructed at the foot of the roof.

79. Roof cradles shall not be hung at intervals of more than 2.50 m. from one another; every cradle shall be fastened to a strong rope that shall be tested before every occasion of use.

80. (1) For repair work in connection with and on roofs precautions shall be taken to prevent the falls of insured persons, building materials and tools.

(2) On roof surfaces with a slope of over 20° work shall be done only from roof ladders or regulation working scaffolds.

(3) For all repair work on roofs with a slope exceeding 45° the insured persons shall, in addition, be roped unless such work is done from regulation working scaffolds."

(R. 1.1.1930.)

BELGIUM

" When the operations are being carried out on roofs, bell towers, cornices, chimneys and other similar places the precautions called for by the circumstances shall be taken to prevent a fall of workers."

(R.O. 31.3.1905, sec. 4.)

BULGARIA

" 45. Work on roofs with a pitch exceeding 30 per cent. shall be done by means of special ladders suitably fixed. Every worker shall be provided with a safety belt of the type used by firemen, allowing him to attach himself to a rope fixed to the roof joists. The workers shall not wear nailed footwear."

(O. 4.5. 1935.)

UNITED STATES

California

"Order 1128. *Erection of wooden trusses* (a) All wooden trusses must be well braced laterally, preferably by a bracing truss, to prevent overturning while under construction.

(b) Roof purlins shall not be used as walkways between trusses, except when they comply with table as shown in section (c) and all such walkways shall be not less than twenty-three (23) inches in width.

(c) The size of planks and distance between supports shall be governed by the following table:

Material	Size of planks (inches)	Span allowed (feet)
Oregon pine or equal straight grain	2 × 6	6
" " " " " "	2 × 8	8
" " " " " "	2 × 10	10
" " " " " "	2 × 12	12
" " " " " "	2 × 14	14"

(S.O. 1.7.1926.)

Ohio

Roofing Devices

"Section 229. Devices used in the construction of pitched roofs or construction on pitched roofs, shall be securely fastened in place. Shingling footlocks shall be not less in size than two by four (2 × 4) inch timber secured in place by properly spaced tin strips, not less than four (4) inches wide, or other material of equivalent strength.

Section 230. Crawling boards, ladders or chicken ladders shall be used wherever necessary to provide protection against slipping or falling of employees. Cleats shall be provided on crawling boards securely fastened thereto, not less in size than three by one (3 × 1) inches and shall project approximately two and one-half (2½) inches on each side of the board.

Section 231. Where crawling boards are double they shall be securely bolted together by a hinge bolt or otherwise substantially secured. When single, they shall be provided with hooks, bolts or solidly fastened cleats on the under side at the upper end to catch over the ridge-pole or otherwise substantially secured."

(S.R. March 1931.)

Pennsylvania

"Rule 10 (a) Where brackets are used for shingling and roofing, they shall be supported by means of ropes passing over the ridgepole of the building or by means of pointed projections with points secure and thrust deeply into the woodwork of the building.

(b) Where ropes are used, they shall be securely fastened to the brackets and to some permanent part of the roof, such as the chimney or cupola, or to some solidly fixed object on the farther side of the building; or by five-eighths (5/8) inch eye bolts, solidly screwed into sound, heavy timber. Ropes shall conform to the requirements set forth in Rule 21.¹

(c) Where horizontal scantling with shingles nailed thereto is used, the scantling shall be at least two by four (2 × 4) inches in cross section, and the shingles shall be securely nailed to the roof. Where the scantling is fastened to the roof by means of strips of sheet zinc or other material being nailed to the under sides of the scantling and to the roof, the nails used shall be of ample length and sufficient in number to insure safe working conditions.

(d) All roofs of quarter pitch or more that do not have a permanent gutter of sufficient size built therein to provide safety for employees working on the roof shall have a standard scaffold or catch platform erected to within

¹ See under §5 "Ropes and Chains."

two (2) feet of the eaves, and to extend at least two (2) feet from the extreme line of eaves projection.

Rule 11. (a) Crawling boards or “chicken ladders” shall be at least ten (10) inches in width and not less than one (1) inch thick. The cross strips shall be as long as the width of the boards, at least one and one-half (1½) inches wide and not less than one (1) inch thick.

(b) Where crawling boards are double, they shall be securely bolted together by a hinge bolt, with the hinge resting on the peak or ridgepole of the roof. Where single, they shall be provided with hooks, bolts or solidly fastened cleats on the underside of the board at the upper end, so arranged as to hook or catch over the peak or ridgepole of the roof. If bolts or cleats are used, the upper end of the board shall also be nailed to the roof to prevent the board from slipping in an upward direction, thus disengaging the hold.

(c) Where crawling boards or “chicken ladders” are used by roofers and where the roof is of quarter pitch or more, a standard scaffold or catch platform shall be provided as required in paragraph (d) of Rule 10 on roofing brackets and scaffolds, except that on small jobs, life lines, securely attached to some fixed part of the building, may be provided for the workmen.”

(R. 1933.)

Wisconsin

“*Order 3521. Roofing scaffolds.* Appropriate support shall be provided for all workmen who are required to work on inclined surfaces. By appropriate support is meant foot stops or jack platforms, as shown in the accompanying illustrations,¹ ladders, chicken ladders, or equivalent devices or construction, anchored to the surface or framework of the roof or other inclined construction in a manner to carry safely, within the limits of stress provided in this code, the maximum load to which the support may be subjected. By inclined surface under this order is meant a surface having a slope of more than 4 in. rise in 12 in. of horizontal run.”

(G.O. 15.7.1933.)

FINLAND

“29. Before work on a roof is begun, the joists of the top floor shall be covered with scaffolding planks if the laying of the floor itself is not yet finished.

The outside scaffolding shall not be taken down until work on the roof is finished.

Where necessary, scaffolding on a level with the eaves shall be provided with a safety roof to prevent the falling of persons or objects. The safety roof shall be at least half a metre wide and shall have an edge guard not less than 60 cm. high. In default of an ordinary outside scaffolding, the safety roof may be erected on a jib scaffolding.

When roof trusses and other large roofing structures are assembled on the ground, they shall be transferred to their places with all due precautions.

The workers engaged in covering in the roof shall be ensured safe and solid footholds.

Chimneys shall be provided with iron rungs, which shall not be used until a lifeline has been fixed.

On large buildings a gangway with a rigid handrail shall be fixed along the ridge of the roof on the side towards the courtyard.

Ladders shall be used in the repairing of roofs. The said ladders shall rest safely against the roof, and shall be suitably fastened to the ridge of the roof and not to the gutters.

(Res. 15.11.1927.)

FRANCE

Work on Roofs and Framework

“49. In work on roofs and in other work in which the workers are exposed to the risk of serious falls, if there is no scaffolding there shall be installed

¹ Not reproduced.

guard-rails, hooks, toe-boards or other protective devices effectively preventing workers falling to the ground if they slip”

(D.9.8.25, 26.11.1934.)

GREAT BRITAIN

“21. No person shall be employed on the outside of any roof which has a pitch of over 34 degrees, unless a parapet wall, railings, an outside working platform of other efficient means are maintained to prevent the said person from falling from the edge of the roof.

Provided that this Regulation shall not apply to:

- (a) A roof the eaves of which are less than 22 ft. above the ground, or to
- (b) A person employed in the erection of any ironwork or steelwork other than roof covering.

22. No person shall be employed on extensive work on the outside of any roof which has a pitch of over 34 degrees unless the following facilities are provided thereon:

- (a) A suitable working platform, securely supported and of a width of not less than 8½ in., and
- (b) Suitable and sufficient ladders, duck ladders, or crawling boards, properly secured.

Provided that this Regulation shall not apply to a person employed in the erection of ironwork or steelwork.

25. When bedding window frames a platform shall be provided to enable workmen to perform their task without danger to themselves or those below them.”

(R. 21.6.1926.)

IRISH FREE STATE

As for *Great Britain*.

ITALY

“11. During the construction of the cornices of eaves, and in general, any structure projecting from the walls or suspended from vaulting, ceilings and the like, all precautions shall be taken to prevent collapse, provisional scaffolding being erected capable of supporting such structures until their stability is fully ensured.

12. Workers employed near eaves or roof cornices, on inclines at a considerable height, or otherwise in similar dangerous conditions, shall wear a strong belt by which they are attached to ropes lashed to a firm part of the building or scaffold.

An exception shall be allowed to this regulation only if the workers are equally and securely protected from dangerous falls by means of fixed or temporary guards.”

(R.D. 27.5.1900.)

LUXEMBURG

“26. Cornices shall not be placed otherwise than from scaffolding; the scaffolding shall be provided with a guard rail.

All roofing work shall be carried out from scaffolding, except where this is absolutely impossible.

If the pitch of a saddle roof or the upper part of a mansard roof is more than 45°, snow fences shall be placed at the foot of the roof.

In addition, the gutters shall be not less than 40 cm. in periphery and the bottom width of the gutters shall be not less than 25 cm.

Roof hooks shall be placed on both sides of ordinary and dormer windows and chimneys, at a distance of 50 cm. from the edge thereof. If the distance between the window ledges in a mansard roof is more than 2.40 m., an additional hook shall be placed half-way between the two hooks prescribed above.

If the workers engaged on roofing work cannot be protected against falls by means of scaffolding, the employer or contractor shall place life-lines and belts at their disposal, or provide special appliances such as safety trestles, etc. These lines and belts shall be supplied to the workers in good condition.

In the case of work on roofs with a steep pitch or close to the edge on flat roofs, the workers shall wear a safety belt.

Protecting planks shall be placed to prevent the fall of materials or tools, etc., unless sufficient protection is afforded by scaffolding provided in conformity with the regulations.

27. Roofs shall be provided with two or more rows of hooks; these hooks shall be sufficiently strong and shall be protected against rust by a coating of paint.

Roofing ladders shall have sufficiently strong rungs made so that the workers have a safe foothold. Roofing ladders shall not be supported exclusively by the gutters.

.....”
(O. 28.8.1924.)

POLAND

“ 32. (1) For work on roofs, use shall be made of protective scaffolds of a suitable type that prevent the workers from falling. Without scaffolds only repair work shall be done on roofs.

(2) For building operations carried on with outside scaffolds the protective scaffolds shall be installed not more than 1 m. below the edge of the roof. At the corners of the building the protective scaffolds shall reach to 0.50 m. beyond the frontages.

(3) For repair work carried out on roofs without the use of scaffolds and near the edge of the roof or on a roof with a pitch exceeding 30° the workers shall be provided with safety belts fastened to ropes. When hemp ropes are used they shall be at least 1.5 cm. thick. The rope shall be fastened to the belt by means of a spring-hook.

(4) The use of scaffolds, safety belts and ropes on roofs shall not be compulsory in the following cases:

(a) When the edge of the roof is not more than 4 m. above the ground or is provided with a device that prevents falls;

(b) When the work is done with the help of ladders or crawling boards.

(5) When work is done over glass roofs or skylights, such roofs and skylights shall be covered in such a way as to exclude any possibility of accidents to workers.”

(D. 23.5.1935.)

SWITZERLAND

Geneva

“ 21. In the case of a new construction the scaffolding used for the exterior walls shall remain in position until the roofing work is completed. The topmost platform of the scaffolding shall not be more than 1.8 m. below the cornice. It shall be close-planked over the whole width, and have a barrier on the outside extending at least 60 cm. beyond the gutter.

22. Roofing tin work, painting and glass work shall not be undertaken without effective precautions.

.....

87. When fixed scaffolds are erected on roofs, the uprights shall rest on firm parts of the building.

88. For work on roofs or exposing the workers to the risk of serious falls, in the absence of scaffolds there shall be installed hand rails, hooks, toe-boards or other safety devices securely fastened by coach screws that effectively prevent the fall of any man who may slip.

89. Roof ladders shall be strong and solidly anchored.

92. The construction and repair of chimneys on roofs shall not be undertaken without strong scaffolds, which shall be erected properly with a close-planked platform, and regulation handrails and toe-boards.

Further, planks varying in height according to the pitch of the roof shall be placed to prevent the fall of materials."

(R. 25.3.1930.)

Zurich

" 37. The placing or repairing of chimneys above roofs shall not be undertaken without safe scaffolds. These shall be constructed in a regulation manner and be provided with closely laid flooring, toe-boards and guard rails. As a protection against falling materials suitable guard boards shall be placed on the roof.

48. Roofers', tinsmiths' painters', mechanics', erectors', and glaziers' work shall not be undertaken without secure scaffolding.

The builder, his supervisory officials, the workers, the architect or quantity surveyor and the owner of the building shall be responsible for compliance with the following provisions, and in particular for seeing that the prescribed protective scaffolds are installed before the work is begun and remain in place until the work is fully completed.

49. The painting of the outside of roof gutters and gable boards of roof cornices shall be allowed up to a height of 6 m. without scaffolds. If such work is undertaken at a height of over 6 m., a written notification shall be sent to the scaffolding inspectorate, which after inspecting the place shall decide whether the work can be done without a scaffold from the roof.

The painting of roof gutters, gable boards and roof cornices from lean-to ladders shall be prohibited at heights of over 6 m.

50. The scaffolds erected for the building of outside walls in new construction or alterations shall remain in place until all roof work is completed. In this connection, the top-most scaffold platform, which shall not lie lower than 1.3 m. below the main cornice, shall be closely laid over its entire width with boards, and on the outside be provided with a guard wall extending at least 60 cm. above the roof gutter and well fastened. If the scaffold is unusually wide the height of the guard wall may be reduced to 1 m.

In the case of mansard roofs a scaffold two planks wide with toe boards and hand rails shall be erected 1 m. below the change of pitch.

Similar scaffolds shall be erected for the installation of dormer windows.

51. All new roofs or roofs to be altered or recovered, if of slate, tile, eternite, sheet iron or concrete, and having a pitch of 30° shall be provided with strong roof-ladder hooks on the upper and lower roof, in horizontal rows not more than 3 m. apart and not more than 2.1 m. apart in each row.

The hooks shall be of galvanised iron with a cross section of at least 2 cm². and be curved to fit the roof laths. Each hook shall be fastened to rafters with three nails at least 2.5/100 mm.; the nail holes of the hooks shall not be larger than the nails. In the case of a shingle lining the stakes of the upper roof shall be fastened with No. 21/120 nails and those of mansard roofs with No. 150 nails.

Further on all the roofs mentioned in section 52 (upper and lower roofs) and when undertaking the recovering of old roofs, safety devices (snow guards) shall be fitted and securely fastened by galvanised iron stakes not more than 1 m. apart. The said stakes of 30 × 7 mm. iron shall be curved and provided with three nail holes similarly to the roof-ladder hooks.

On the roof guard stakes and snow guard stakes at least two bars shall be fitted horizontally.

On spires and other particularly steep roofs the snow guards shall be raised and strengthened as ordered by the scaffolding inspectorate.

The roof gutters shall be fastened with gutter hooks at least 4 mm. thick and 27 mm. wide, which shall be fixed at intervals of not more than 70 cm. to the gutter board at every rafter or to an equally secure anchorage with at least three strong nails. Gutters with a circumference of less than 33 cm. shall not be used on main cornices. Cornice brackets and jack rafters shall be made of boards at least 6 cm. thick.

On roof cornices, where for constructional reasons no gutter boards can be installed, the gutter hooks shall measure at least 5 mm./30 mm.

52. For repairing roofs of any kind the workers shall be secured by protective and catch scaffolds and by the use of stout ropes fastened to a strong belt. Ropes splashed by hydrochloric acid or soldering flux shall not be further used. On particularly dangerous work a man shall hold the workers doing the work by a lifeline from a safe place.

For minor roof repairs guard boards 60 cm. wide shall be placed and well fastened in the gutter; on very steep roofs the guard boards shall be higher to an extent corresponding to the pitch of the roof.

Roof ladders shall be solid and the rungs so made that the workers have a firm foothold.

(R. 31.1.1931.)

URUGUAY

“XX. Scaffolds for the repair or construction of the outside walls shall not be removed before the roof work has been fully completed.

XXI. In the construction of lowers or attics the top-most platform shall be placed at least 0.70 m. above the gutters, shall consist of closely laid boards, and shall be provided on the outside with a stout barrier 0.80 m. high. On new construction the top counter floor shall not be removed until the above-mentioned operations have been fully completed.”

(D. 14.4.1915.)

(b) SAFETY BELTS AND LIFE LINES

GERMANY

“24. (1) For work on dangerous places, in the absence of more specific regulations, insured persons shall be protected against falls by fencing, the erection of working or protective scaffolds, or the use of a safety belt and life line.

(2) Life lines shall be at least 12 mm. thick, and have a belt and safety hooks; the loops of life lines shall be fitted with rustless metal eyes.

78. (1) If a boarded roof is steeper than 45°, the insured persons shall be roped irrespective of the height of the gutter above the ground, unless the roof is enclosed in a regulation working scaffold. The regulation concerning protective scaffolds shall not thereby be affected

(2) For work on lathed roofs, roping shall not be required, if the lathing rests directly on rafters, the pitch of the roof does not exceed 60°, and a regulation protective scaffold is constructed at the foot of the roof.

(3) For all repair work on roofs with a slope exceeding 45°, the insured persons shall in addition be roped unless such work is done from regulation working scaffolds."

(R. 1.1.1930.)

AUSTRIA

" 31. On dangerous work, especially roofing, clearing away snow, installing lightning conductors, and dangerous tinsmiths' or glaziers' work, the workers shall be equipped with a safety belt and rope."

(O. 7.2.1927.)

BULGARIA

" 45. . . . Every worker shall be provided with a safety belt of the type used by firemen, allowing him to attach himself to a rope fixed to the roof joists"

(O. 4.5.1935.)

CANADA

Alberta

" Whenever workmen are required to crawl out on 'thrust outs', and such other places where no protection is afforded them, life lines and life belts of sufficient strength shall be provided for the workmen."

(R. 31.7.1928, sec. 170.)

UNITED STATES

California¹

Similar to *Canada (Alberta)*.

Ohio

Life Nets: Safety Belts: Life Lines

" Section 257. Where workmen are employed twenty (20) feet or more above the ground, floor or similar elevation, in theaters, auditoriums, lobbies, light courts, open shafts and similar places, and it is impracticable to provide temporary floors, stagings, ladders or scaffolds therein, life nets or safety belts shall be provided by the employer for the protection of employees. In cases where life nets or safety belts cannot be used, life lines shall be provided for use of employees engaged on such work.

Section 258. Where temporary floors, stagings, ladders or scaffolds are not provided for employees who are required to work twenty (20) feet or more above the ground, floor or other similar elevations; out on thrustouts or outriggers; adjust or inspect overhead machines; are employed on finished roofs or inclines where the rise exceeds six (6) inches in twelve (12) inches, life nets or safety belts shall be provided for use of employees engaged on such work.

Section 259. Where employees are required to work from window ledges or similar locations twenty (20) feet or more above the ground, floor or similar elevation, shall be provided with safety belts and their use required. Where it is impracticable to use safety belts in such locations, window jack scaffolds shall be provided for use of workmen.

Section 260. The provisions of Sections 257 to 259 inclusive requiring the use of life nets, safety belts and life lines shall not apply to rigging, the erection of hoists, towers, derricks, scaffolds, ladders, elevators, nor to the erection of structural steel in buildings or bridges.

Recommendation: It is recommended and strongly urged that substantial safety belts with clencher tube or other similar device attached thereto which

¹ See also under § 6 (c) "Catch Scaffolds and Protective Roofs".

automatically operates and wedges itself with a jerk of the rope or by sudden weight coming upon it so that the wearer cannot fall, be provided by employers and used by employees in the erection or painting of structural steel in or on buildings, bridges, stacks, poles, steeples, or other similar hazardous operations.

Section 261. Lifelines shall be securely fastened above the operation and shall extend below the operation a sufficient distance to permit a safe landing."

(S.R. March 1931.)

Pennsylvania

"(j) Where it is necessary for workmen to crawl out on 'thrust outs' or projecting beams, life lines and safety belts of approved design shall be worn."

(R. 1933, Rule 1.)

FINLAND

"Workers employed on the roof shall be provided by the employer with a life line and belt and the employer shall carefully examine the condition of the line before it is used."

(Res. 15.11.1927, sec. 29.)

FRANCE

"In work on roofs and in other work in which the workers are exposed to the risk of serious falls, if there is no scaffolding there shall be installed guard rails, hooks, toe-boards, or other protective devices effectively preventing workers falling to the ground if they slip.

When it is impossible to use these protective devices and in work on framework, workers shall be provided with safety belts and ropes enabling them to lash themselves to a fixed point.

.....
In glazier work on a considerable scale, the workers shall be provided with safety belts and ropes, or a platform shall be placed close under the glass to catch a worker who may happen to fall."

(D. 9.8.1925/26.11.1934, sec. 49.)

ITALY

"Workers employed near eaves or roof cornices, on inclines at a considerable height, or otherwise in similar dangerous conditions, shall wear a strong belt by which they are attached to ropes, lashed to a firm part of the building or scaffold.

An exception shall be allowed to this regulation only if the workers are equally and securely protected from dangerous falls by means of fixed or temporary guards."

(R.D. 27.5.1900, sec. 12.)

LUXEMBURG

"If the workers engaged on roofing work cannot be protected against falls by means of scaffolding, the employer or contractor shall place life lines and belts at their disposal, or provide special appliances such as safety trestles; etc. These lines and belts shall be supplied to the workers in good condition.

In the case of work on roofs with a steep pitch or close to the edges on flat roofs, the workers shall wear a safety belt."

(O. 28.8.1924, sec. 26.)

POLAND

"32.

(3) For repair work carried out on roofs without the use of scaffolds and near the edge of the roof or on a roof with a pitch exceeding 30° the workers shall be provided with safety belts fastened to ropes. When hemp ropes are

used they shall be at least 1.5 cm. thick. The rope shall be fastened to the belt by means of a spring-hook.

(4) The use of scaffolds, safety belts and ropes on roofs shall not be compulsory in the following cases:

(a) When the edge of the roof is not more than 4 m. above the ground or is provided with a device that prevents falls;

(b) When the work is done with the help of ladders or crawling boards.

(D. 23.5.1935.)

SWITZERLAND

Geneva

"Contractors shall require those of their workers who are employed on sloping roofs or cornices, or who erect or dismantle high scaffolds, to lash themselves securely. For this purpose they shall supply the workers with the necessary equipment and see that a man holds the rope."

(R.25.3.1930., sec. 86.)

Zurich

"52. For repairing roofs of any kind the workers shall be secured by protective and catch scaffolds and by the use of stout ropes fastened to a strong belt. Ropes splashed by hydrochloric acid or soldering flux shall not be further used. On particularly dangerous work a man shall hold the workers doing the work by a life line from a safe place. . . ."

(R. 31.1.1931.)

CZECHOSLOVAKIA

"60. When carrying out dangerous work, especially roofing, removing snow, cleaning windows, fitting lightning conductors, certain plumbers' glaziers' and painters' work, building factory chimneys, erecting lofty iron structures and similar operations, workers shall use a safety belt and a properly fastened life line with which the employers shall provide them and which shall always be available when required. The life line or safety belt shall be fastened to sound and stable parts of the roof truss and similar firm parts, but not in any case to the roof laths."

(O. 26.3.31.)

UNION OF SOVIET SOCIALIST REPUBLICS

"91. When the work of erecting scaffolding is carried out at a certain height and no suitable flooring has been laid, the workers shall be provided with life lines, and the management of the undertaking shall provide for effective supervision to ensure that the workers in question are firmly secured by these ropes.

116. When working on roofs with a pitch of more than one quarter of the width of the building, or on roofs of lesser pitch that are covered with snow or hoar-frost, or, in general, when the surface of a roof is damp, the workers on the roof shall be provided with life lines, and the management of the undertaking shall organise effective supervision to ensure that the workers in question are actually securely held by ropes, the free ends of which are firmly attached to some solid part of the building.

117. When work is being carried on at the edge of a roof (e.g. plastering or painting the cornice at the base of the parapet, etc.), the worker shall be lashed by a rope, whatever the pitch of the roof."

(O. 5.5.1930.)

URUGUAY

"Workers employed on roofing operations and other similar work shall gird themselves about the middle with a stout belt, attached to a rope which shall be lashed at one end to a sufficiently strong part."

(D. 14.4.1915, sec. XXII.)

"1. In constructional work with reinforced concrete as a basis, wire netting not less than 3 m. wide shall be placed round the front of the building and beneath the floor under construction as a protective and safety device.

The said netting shall be stretched over beams with a section of $7\frac{1}{2} \times 7\frac{1}{2}$ cm. and placed at an average distance of 3 m. from each other, with an inward slope of 30 degrees.

2. Workers employed on various tasks in the said constructional work, e.g. on the channels for running in the concrete, etc., shall be supplied with a safety belt, which shall be attached to parts of the building sufficiently strong to ensure the safety of the worker in cases where, in view of the nature of the work, the use of scaffolding in accordance with the provisions in operation is found to be impossible."

(D. 4.1.1928.)

YUGOSLAVIA

"Every worker employed in roofing, the fixing of lightning conductors, soldering and glazing on roofs, steeples, chimney stacks and chimneys shall be equipped with a safety belt and rope."

(D.25.10.1921, sec. 129.)

(c) WORK ON GLASS ROOFS AND OTHER GLAZING WORK

GERMANY

"81. (1) Glass roofs and other roofs made of fragile building materials without boarding (e.g. asbestos tile roofs) shall only be covered in if there are protective scaffolds under the workplace.

(2) Walking on the roofs specified in paragraph 1, on skylights and on glass roofs shall be prohibited; to prevent them from being walked on safety precautions shall be taken.

(3) For cleaning and repairs working scaffolds or ladders shall be used; in the latter case the insured persons shall rope themselves.

(4) For work on and over their upper surface, such roofs, skylights and glass roofing shall be covered."

(R. 1.1.1930.)

AUSTRIA

"When glass roofs are being filled in, a closely planked scaffold shall be erected underneath; broken glass shall be removed immediately."

(O. 7.2.1907, sec. 31.)

FRANCE

"Persons working on glass roofs shall work on scaffolds, platforms or ladders so that their weight is not supported directly by the glasswork.

In glazier work on a considerable scale, the workers shall be provided with safety belts and ropes, or a platform shall be placed close under the glass to catch a worker who may happen to fall.

Broken glass shall be cleared away immediately."

(D. 9.8.1925/26.11.1934, sec. 49.)

GREAT BRITAIN

" . . . A width of at least $10\frac{1}{2}$ in. shall be sufficient for a working platform used for glazing a roof, if the said platform is bolted or otherwise firmly fixed at one end to a bracket securely hooked to a purlin and rests securely at the other end on another purlin."

(R. 21.6.1926, sec. 4.)

IRISH FREE STATE

As for Great Britain.

LUXEMBURG

" The construction and repairing of glass roofs shall not be carried on otherwise than from strong scaffolding floored with closely laid boards or from firmly secured ladders."

(O. 28.8.1924, sec. 28.)

POLAND

" 32.

(5) When work is done over glass roofs or skylights, such roofs and skylights shall be covered in such a way as to exclude any possibility of accidents to workers."

(D. 23.5.1935.)

SWITZERLAND

Geneva

" Workers employed on glass roofs shall work on scaffolds, platforms or ladders that prevent them from bearing directly on the glass.

For large-scale glazing a platform shall be installed a short distance below the glass to catch the workers if they fall. Broken glass shall be immediately removed."

(R. 25.3.1930, sec. 90.)

Zurich

" 48. . . . Glaziers' work shall not be undertaken without secure scaffolding.

53. For work on glass roofs a scaffold shall be required underneath the roof and similarly for the installation of large heavy windows (staircase, hall, church windows, etc.)."

(R. 31.1.1931.)

CZECHOSLOVAKIA

" 61. (1) For the first glazing of glass roofs, considerable repairs thereto and roofing work in general in buildings where the roof is at the same time the ceiling, scaffolding covered with strong closely-laid boarding and securely enclosed on the outer sides shall be erected under the roof or the part thereof in question. The same rule shall apply to the painting of the iron framework of roofs, repairs to lighting shafts, etc. Broken glass shall be removed at once. Sufficiently strong overlapping boards shall be laid on an open supporting structure overhead for use as a gangway.

(3) Window-glazing shall always be done from safe scaffolds or ladders."

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

“118. The fitting or repair of glass roofs or of skylights shall not be undertaken until close planking or some other screen to catch falling glass and other objects has been fitted underneath the workplace, or until a barrier has been fitted to prevent access to that point.

Such work shall not be authorised unless the worker is on a ladder securely anchored on a platform or planking lying on the cross beams or on the roof.”

(O. 5.5.1930.)

§ 8. — Miscellaneous Rules

(a) SPECIAL REGULATIONS FOR FACTORY CHIMNEYS

GERMANY

“84. (1) At the hoist opening and at the entrance a protective roof as in section 47¹ shall be erected. The remainder of the workplace shall be covered or fenced off and provided with warning notices.

(2) In the case of internal hoisting, in addition a protective scaffold shall be erected immediately over the men working below.

(3) The inside working scaffolds shall be erected on wooden bearers or iron brackets resting in the masonry. Iron brackets shall not be inserted less than 40 cm. below the last course of bricks.

(4) Under each working scaffold the next lower scaffold shall be left as a protective scaffold. In the case of work from hanging truss scaffolds (bracket scaffolds) this provision shall not apply.

87. (1) For outside work on chimneys working scaffolds shall be used.

(3) . . . Chimneys without outside iron rungs shall only be climbed by means of extension ladders, which shall be provided with fixed iron stops, and in the case of extension shall be slid one in another. Short ladders hung in enclosing chains or wire ropes shall be allowed. The lowest ladder shall rest on a firm and immovable base. Every ladder shall be secured against side displacement.

89. (1) Bracket scaffolds shall not be fastened to hooks, iron rungs, or hammered-in clamps; they shall be provided with a hand rail of rope or chain, and each one hung in two enclosing wire ropes, chains or rings. The chains shall be crane chains with a safety factor of at least eight and made of best quality, officially tested material; the wire ropes shall be of crucible cast steel with a safety factor of at least eight. The chains shall be fastened together by shackles, the wire ropes by two clamps. The chains and wire ropes shall be secured against slipping by means of hooks driven in underneath at intervals of about 1 m.

(2) The jibs for building hoists in outside work shall not be fastened to the same chains or ropes as carry the scaffolding.

90. (1) If the outside iron rungs are used, then to prevent a fall being caused by the wrenching out of a newly embedded rung, while a chimney is being built up, a rope 2 cm. thick shall be fastened inside, about 2 m. down, to

¹ See under § 6 (c): “Catch Scaffolds and Protective Roofs”.

the rung. The rope shall overhang at least 3 m. outside so that the insured persons can use it when climbing over the edge of the chimney.

(2) The binding of chimney stacks with rings shall only be done from regulation scaffolds, including bracket scaffolds.

91. (1) In demolishing chimney stacks bracket scaffolds shall not be loaded with building materials.”

(R. 1.1.1930.)

POLAND

“ 33. (1) The construction of chimneys shall be entrusted to a specialised undertaking employing skilled workers who are perfectly familiar with this kind of work.

(2) Underneath the place where the materials are hoisted, whether inside or outside the chimney, a protective roof shall be installed to safeguard the workers below against any accidental fall of objects.”

(D. 23.5.1935.)

CZECHOSLOVAKIA

“ 77. (2) To protect the workers employed on the ground, a closely planked safety roof of strong squared boards inclined towards the chimney shall be fixed at the hoist or at the entrance to the chimney. The other work-places below the chimney shall also be fenced or protected by a safety roof.

(3) A safety scaffold shall be placed about 2 m. below each working scaffold inside the chimney to protect the workers employed in building the walls of the chimney.

(4) If materials are hoisted inside the chimney, a safety roof shall be erected there also, immediately above the workers employed on the ground. Any ascent into the interior of the chimney outside the space covered by the safety roof shall be strictly forbidden. Poles with hooks shall be used for handling the receptacles for the conveyance of materials in the bottom of the chimney.

78.

(3) The outside working scaffold and its brackets shall not be secured to the rungs, but only to a circular brace.

(4) The scaffold boards (staging) shall be properly secured to prevent their slipping off the brackets. The boards shall not be nailed on. The scaffold shall be provided with a guard-rail.

(5) The binding of a chimney with iron rings shall always be effected from suitable scaffolding.

79.

(3) Continuous fencing not less than 60 cm. high shall be erected to prevent persons from falling into the opening in the scaffold if materials are hoisted from the inside. In the case of chimneys of small diameter it shall be sufficient if the opening is firmly and safely covered.

(4) In work of all kinds on factory chimneys which is not carried out from an outside scaffold, the workers shall wear a safety belt fitted with a safety hook, the life-line of which shall be sufficiently long and thick and properly secured. The employer shall provide the safety belt and the appurtenances thereof.”

(O. 26.3.1931.)

(b) ELECTRICITY HAZARDS

GERMANY

“ 33.

(2) Near unprotected live bare wires or apparatus, and near high tension even in insulated wiring or apparatus, work shall only be done when the wiring

or apparatus has been removed or made dead, or precautions have been taken that prevent contact with a live part. While the precautions are being taken or abandoned, the wiring and apparatus shall be removed or made dead.

(3) The employer or his representative shall see that until the termination of the work the wiring is either dead or protected against contact.

(4) Wiring for building undertakings shall be insulated and laid at least 3 m. from the ground or floor level, and 2.50 m. from roofs, structural projections, windows or other accessible places, and in such a manner that it cannot be reached without special appliances".

(R. 1.1.1930.)

AUSTRALIA

Western Australia

"(1) Every owner of scaffolding who intends to erect scaffolding adjacent to or under or over any electric wires shall give notice of the presence of such electric wires to an inspector at least twenty-four hours before the commencement of such erection, and the inspector shall forthwith notify the electric supply authority or other person or authority having control of such wires thereof.

(2) Upon receipt of such notice from the inspector, the electric supply authority or other person or authority aforesaid shall thereupon remove or make safe such wires.

(4) No person shall erect scaffolding in such a position as may make it possible for any person to come into contact with any live electric wires under any circumstances whatsoever.

(5) No person shall erect scaffolding in such a position as may make it possible for any material or plant which may be carried by any person or persons to come into contact with any live electric wires under any circumstances whatsoever. Live wires shall not be attached to any scaffolding without the approval in writing of the Inspector, and no Inspector shall give such approval unless approved insulated cable is used.

(6) No bare wires shall be used to supply light or power to any apparatus or plant on or under any scaffolding. All live wires shall be at such a distance from scaffolding that they cannot be touched by a person leaning over or carrying out his usual duties on such scaffolding."

(O. in C. 9.2.1927.)

AUSTRIA

"Electric light wires shall be insulated throughout as a protection against contact."

(O. 7.2.1907, sec. 33.)

UNITED STATES

California

Order 1110. "(a) All electrical fixtures and equipment used on construction work shall be safeguarded as specified in the *Electrical Safety Orders*."

(S.O. 1.7.1926.)

Pennsylvania

"(c) . . . Where runways pass near . . . high tension wires. . . guard rails and toe boards shall be provided on both sides of the runways or the dangerous points effectively guarded."

(R. 1933, Rule 17.)

Wisconsin

"*Order 3537. Electrical hazards. 1. Protection from adjoining power and light lines.* No part of a structure in progress of erection, including accessory scaffolds, towers, power equipment, booms and other fixed and movable equipment constructed or used in connection with a construction

project, shall extend nearer to conductors carrying electrical current than the distance indicated in the following table:

Voltage of conductors	Minimum vertical clearance at conductors	Minimum lateral clearance (in feet)	
		Bare conductors	Insulation covered conductors
300 or less	8	3	3
More than 300, to 750 . . .	8	8	3
More than 750, to 7,500 . .	10	10	10
More than 7,500	10 plus 1-10 foot for each 1,000 volts over 7,500	10 plus 1-10 foot for each 1,000 volts over 7,500	10 plus 1-10 foot for each 1,000 volts over 7,500

By insulation is meant as defined in the Wisconsin State Electrical Code. See section 348.38 of the Wisconsin Statutes regarding "Injury to Wires by Removal of Building, etc."¹

Note. — In every case where work is to be done in close proximity to current carrying conductors, the operator of such conductors should be notified in writing."

(G.O. 15.7.1933.)

FINLAND

"Electrical conductors at building workplaces shall be fixed and maintained so that the workers cannot accidentally come into contact with them and they are not dangerous to the workers in any other way."

(Res. 15.11.1927, sec. 2.)

FRANCE

"59. When workers have to work within 3 m. of conductors or supports of electrical transmission or distribution lines, the employer, before beginning the work and after concerting with the person operating the line shall take the necessary measures to ensure the safety of the workers employed at the workplace for the whole duration of the work."

(D. 9.8.1925/26.11.1934.)

GREAT BRITAIN

"45. . . . All electrical apparatus and electrical conductors shall be so installed and protected as to prevent danger to any person employed."

(R. 21.6.1926.)

Note. — Premises on which power driven machinery is temporarily used for the purpose of the construction of a building or any structural work in connection with a building are also covered by the General Code of Electricity Regulations for premises under the Factory Acts, dated 23 December 1908. (Statutory Rules and Orders, 1908, No. 1312.)

SWITZERLAND

Geneva

"147. It shall be prohibited to erect scaffolds or other installations near electrical conductors, even under low tension, without having taken the necessary precautions in agreement with the Electricity Department."

(R. 25.3.1930.)

¹ Not reproduced.

Zurich

" 63.

Heavy current cables running along the scaffold shall be protected by armoured conduits or zores iron.

64. Before beginning work near heavy current wiring suitable precautions shall be taken in accordance with instructions to be obtained from the electricity supply undertaking."

(R. 31.1.1931.)

CZECHOSLOVAKIA

" (5) The wiring for electric lighting and other electrical conductors and the electrical apparatus used in constructional works shall be efficiently protected against involuntary contact; the instructions and rules laid down by the Czechoslovak Electrotechnical Association shall be observed in all matters for which official regulations are not issued by the competent authorities.

(6) When constructional work or repairs are being carried out in the vicinity of an electrical conductor (in particular that of a high tension cable), care shall be taken that the current is cut off or that the conductor is protected on all sides so that dangerous contacts are obviated."

(O. 26.3.1931, sec. 65.)

(c) PROTECTION OF THE PUBLIC

CANADA

Alberta

" 10. In cities and towns the following regulations shall be complied with in erecting, altering or repairing any building, provided such city or town has not by by-law made regulations regarding such matters:

- (a) When the work is located on the line of any street or within 3 ft. of the inside line of the sidewalk of any street, before any of the work above the sidewalk or footway is commenced, there shall be erected over the sidewalk or footway of the street a covered passageway or independent structure not less than 8 ft. high at the lowest side above the level of the sidewalk or footway and of sufficient strength to protect the public using the sidewalk or footway;
- (b) If a building or excavation is to be erected or made within 7 ft. of the inside line of the sidewalk on any street, a strongly constructed close-boarded fence or barricade, not less than 6 ft. high, shall be erected along the inside line of such sidewalk."

(Revised Statutes, 1922, ch. 193.)

Manitoba	}	As for <i>Alberta</i> .
Ontario		
Saskatchewan		

CHILE

" 382. The site of all new construction, repairs, alteration or demolition shall be shut off from the public highway by a provisional hoarding of timber, galvanised iron or other adequate material, which shall not be less than 2.50 m. in height and shall be secured by poles of a diameter of not less than 0.075 m.

383. The provisional hoarding of buildings under construction along the street frontage shall not occupy more than half the width of the pavement provided that the latter is over 1.50 m. wide. Otherwise the hoarding may occupy up to 0.70 m. of the pavement measured from the building line. The hoarding shall be taken down as soon as the frontage wall has reached the

height of the first storey; and may be re-erected when the wall of the ground floor is being plastered

396. Whenever it is deemed necessary by the Directorate of Municipal Works, the first floor of scaffolds in public highways shall be made of boarding tongued and grooved together, with side boards also tongued and grooved together, so that the public can pass by safely and without inconvenience."

(R. 14.1.1930.)

UNITED STATES

California

"Order 1159. (a) Whenever a building shall be erected or increased to over two (2) storeys in height, or whenever such a building, being more than twenty-five (25) feet in height is to be demolished within the fire limits of any municipality or upon any street of a municipality on which municipal ordinance or regulations will not allow sidewalks to be blockaded, the owner, builder or contractor constructing, repairing or demolishing such building shall erect and maintain during the period of such construction or repair, a shed which shall extend over not less than one-half the width of the sidewalk and shall have a minimum width of three (3) feet. The sidewalk of the shed must be constructed to support a live load of one hundred (100) pounds per square foot. The side wall towards the building shall be sealed with boards. The roof over the shed shall be constructed to support a live load of thirty-five (35) pounds per square foot, but in no case shall the planks on the roof be less than two (2) inches in thickness. The live load as specified above for sidewalk and roof shall be employed with a safety factor of four (4) and all supports, including connections, posts and footings, shall be of sufficient strength to develop the strength of the main members of the structure. Such temporary sidewalk shed shall remain in place until the building is enclosed, or in case of demolition, until the building has been entirely demolished. Every sidewalk shed shall be kept in good repair, free from unnecessary obstructions and properly lighted at night."

(S.O. 1.7.1926.)

Pennsylvania

"(e) Where construction operations are adjacent to a sidewalk, alley, street or other thoroughfare and the same is not closed to traffic, a substantial "sidewalk shed" or "bridge" shall be constructed.

(f) Wherever the material on a scaffold is piled higher than the toe board and where the scaffold is suspended or built over exposed sidewalks, streets or other thoroughfares, the openings between the toe board and guard rail shall be covered by means of expanded metal or wire netting of mesh not greater than one-half ($\frac{1}{2}$) inch or other equivalent side screen may be provided."

(R. 1933, Rule 23.)

LUXEMBURG

"12. In demolition and constructional work the safety of the passers-by shall be ensured by the erection of a protective hoarding on the street side. This protective hoarding shall be sufficiently high and shall be provided with a roof not less than 1 m. wide and sloping inwards."

(O. 28.8.1924.)

MEXICO

"532. On all new buildings or renovation of frontages, a close planked boarding not less than 2 m. in height shall be erected at a distance of not less than 2 m. from the wall so as to prevent injury to passers-by through objects falling from the scaffold."

(R. 28.11.1934.)

NORWAY

"113. When the site of building operations adjoins a street, public place or passage, it shall be enclosed by a hoarding of adequate strength and solidity,

to a height of not less than 2 m. above the ground or pavement. If the distance between the hoarding and the scaffold is less than 1.5 m., a strong penthouse, usually inclined at an angle of 45°, shall extend to a horizontal distance of 1.5 m. outwards from the scaffold along the whole length of the scaffold. On the outer side of the scaffolding a solid vertical screen shall be fitted to a height of 1.3 m. from the level of the lower edge of the penthouse so as to prevent objects falling on the penthouse from rebounding on to the scaffold.

One or more gates shall be provided in the hoarding as required. If the building authorities consider it necessary, the passages from these entrances to the building shall be roofed in.

The building authorities shall have power to grant exemptions from the provisions of this section where they consider it permissible."

(R. 6.10.1928.)

POLAND

"3 (1) The ground actually occupied by the works in progress shall be shut off by an enclosure from places accessible to the public. The enclosure shall be such as to avoid any risk that might arise from the fall of any objects whatsoever. Places on the building site that are accessible to the workers shall be protected in a similar manner

23. (1) Outside scaffolds that are in the immediate vicinity of traffic-carrying roads shall be provided on the side towards the road with a protective roof sloping at an angle of 45° towards the inside.

(2) According to the extent and character of the work, the protective roofs may form an independent structure or be installed on brackets suitably fixed to the uprights or to the ladders. The covering planks shall be at least 24 mm. thick.

(3) The use of protective roofs as scaffolds or for the storage of materials shall be prohibited."

(D. 23.5.1935.)

SWITZERLAND

Geneva

"6. The frontage of every workplace on a public thoroughfare shall be completely shut in outside the hours of work.

41. When the communal or cantonal police authorities require protective scaffolding on pavements for repairing frontages, plastering, roughcasting, and painting in traffic-carrying streets, these scaffolds shall be strong enough to allow workers to move about on them and materials to be deposited. They shall be provided with guard boards, inclined at 45° and extending to a height of 0.80 m. all round the outside edge. There shall be no gap between the protective scaffolds and the frontages."

(R. 25.3.1930.)

Zurich

"4. When building work is being undertaken every building site shall be shut off from roads, paths and yards used by persons by a hoarding at least 1.50 m. high

In districts with detached buildings, on roads with little traffic, and subject to the authorisation of the scaffolding inspectorate, the enclosure may be made of stanchions or omitted altogether.

5. The scaffolding inspectors shall supervise the enforcement of the provisions laid down in these regulations; in addition they shall be authorised to order such further measures as special circumstances may show to be necessary.

34. When scaffolds¹ are erected over streets, paths and yards used by persons, if traffic is not blocked by a hoarding at least 1.80 m. from the scaffold poles, a strong protective roof shall be erected with at least 1.50 m. overhang, leaning towards the building, and extending the whole length of the building, and in any case where there are approaches and entrances to buildings, at a height of at least 3.50 m. above the ground. Such protective roofs shall have at least three bearers for every plank length and shall not be walked upon or used for the storage of building materials.

If, for plasterers' scaffolds neither a hoarding nor a protective roof is necessary, the attention of the public shall be drawn to the danger by conspicuous warning notices."

(R. 31.1.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

"88. . . . When scaffolding is erected at a point where many people pass, it shall be protected by a close-planked fence 2 m. high."

(O. 5.5.1930.)

URUGUAY

"IV. When construction operations . . . are carried on, over or alongside public ground, they shall be fenced off from traffic.

V: When the scaffolds extend towards the street they shall be fenced off from it by means of a hoarding; or at a height of 3 m. above the pavement a protective roof shall be erected, consisting of closely laid planks, at least 0.04 m. thick and leaning towards the building."

(D. 14.4.1915, secs. IV and V.)

(d) RULES FOR THE WORKERS

GERMANY

"12. (1) The insured persons shall be obliged to comply with the safety regulations and to use the safety devices; they shall also take the necessary precautions for their own or their workmates' protection; and abstain from anything that might endanger themselves or their workmates.

(2) The insured persons shall ask for missing equipment in good time . . . ; they shall remedy defects immediately or report them to the employer or his representative. Unauthorised alteration of working equipment, and the removal, rendering useless, or damaging of safety devices shall be forbidden. Appliances, equipment and safety devices shall only be used for the purposes for which they are intended.

17.

Insured persons shall be allowed access to the workplaces only in so far as is necessary for the performance of the duties assigned to them. For going to and from workplaces use shall be made only of the means of access and egress provided for the purpose."

(R. 1.1.1930.)

AUSTRALIA

Queensland

"(ix) No workman shall remove any brace, plank, putlog, or standard from any scaffolding without the authority of the licensed scaffolder or other person in charge."

(R. 25.2.1916, sec. 16.)

¹ Scaffolds for plasterers, painters and repairers.

Western Australia

Similar to *Queensland*.

AUSTRIA

"47. The following disciplinary rules for the workers shall be brought to their notice in full, and for this purpose shall at least be posted up permanently and legibly at a generally accessible place on the building under construction, and if necessary at other places also.

The attention of every worker shall be specially drawn to Point 22 (reporting of accidents) at the time of his engagement.

(1) It is prohibited to throw down tools, timber, bricks, stones or other heavy objects from scaffolds or from the building.

(2) The loosening of clamps shall be carried out so that they neither break nor fly off.

(3) Any unauthorised removal of scaffold parts, ladders, boards, putlogs, clamps, trestles, flooring, etc., and in general any unauthorised alteration in the equipment is prohibited.

(4) In raising and lowering suspended scaffolds the winding appliances shall be worked equally so that the scaffold does not slant. When not in use the cranks of winches shall be blocked or removed.

(5) Except in the case of high tower and chimney scaffolds, remaining on the scaffold during the midday break is not allowed.

(14) On dangerous work, particularly roofing and removing snow, installing lightning conductors, dangerous tin-smiths' and glaziers' work, the workers must use the safety belts and ropes provided for them. Such ropes, if there are no special devices on the roof for fastening them, must be securely fastened to the ladder scaffolds customarily used.

(19) All damage to, or suspicious conditions in connection with, any building equipment must be immediately reported to the person placed by the employer in charge of the work.

(20) The use of working and safety equipment for purposes other than those for which it is intended is prohibited.

(21) Workers are forbidden to interfere with working equipment, machinery, electric wiring, etc., for the attendance, use or maintenance of which they are not responsible, and to endanger themselves or others by behaviour contrary to the interests of the building undertaking, by larking, horseplay, quarrelling and other unruly actions.

(22) Every accident must be immediately reported to the person in charge either by the victim, or, if he is unable to do so, by the witnesses of the accident."

(O. 7.2.1907.)

BELGIUM

"18. The workers shall see that the boards on which they have to move about are supported, blocked, anchored and suitably assembled.

They shall not move about or remain near the feet of ladders unless required to do so by their work. In any case they shall not remain there during the transport of any materials or loads whatsoever, or in a general way, move about or stand unnecessarily under moving or hanging loads.

They shall be forbidden to use ladders from which a rung is missing, or of which a rung is broken, split or loose.

19. The workers shall be bound to report to the employer or to his representative all defects that they may find in the appliances or equipment provided for them."

(R.O. 31.3.1905.)

BULGARIA

" 15. Workers shall be required to conform to the rules concerning safety, and to use the equipment intended for the prevention of accidents. The employer shall be notified of missing or defective equipment.

Workers shall not go barefoot during operations, and shall not rest nor sleep in dangerous places."

(O. 4.5.1935.)

UNITED STATES

California

" *Order 1103 (a)*. Every employee shall use all safeguards, safety devices or appliances furnished him for his protection, and shall carry out all safety orders which pertain to his work.

.....
Order 1112 (a). No employer, employee or other person shall remove or make ineffective any safeguard, safety device or safety appliance which is in use, except for the purpose of making repairs or adjustments; and any person or persons who remove or make ineffective such safeguard, safety device or safety appliance for repairs or adjustments, shall replace the same immediately upon the completion of such repairs or adjustments."

(S.O. 1.7.1926.)

Pennsylvania

" (c) Every employee shall use all safeguards, safety appliances or devices furnished for his protection and shall carry out all Safety Standards which may concern or affect his conduct."

(R. 1933, sec. 1.)

Wisconsin

" (2) No employee shall remove, displace, damage, destroy or carry off any safety device or safeguard furnished and provided for use in any employment or place of employment, or interfere in any way with the use thereof by any other person, nor shall any such employee interfere with the use of any method or process adopted for the protection of any employee in such employment, nor fail or neglect to do every other thing reasonably necessary to protect the life, health, safety or welfare of such employees or frequenters."

(Industrial Commission Law, sec. 101.07.)

FRANCE

" In addition, regulations shall be posted up at the same spots¹ in all fixed workplaces instructing the workers to observe the following rules:

(1) Workers who have had to remove certain safety devices (guard-rails, drapdoors, etc.) in order to perform certain tasks, shall replace them immediately afterwards.

(2) No worker shall come down to a scaffold by jumping from a higher point.

(3) Before throwing down rubbish or materials, a worker shall give warning to those in the vicinity and shall make certain that they run no risk of being struck."

(D. 9.8.1925/26.11.1934, sec. 60.)

GREAT BRITAIN

" 49. Every person employed shall co-operate with the employers in carrying out Part I of these Regulations, and shall report to the employer or foreman any defect he may discover in the plant or appliances.

¹ The workmen's shelter and the place where wages are paid.

50. No person employed shall interfere with, take away, or destroy any of the plant or safeguards required by these Regulations without the authority of the employer or his responsible foreman.

51. No person employed shall be lifted or carried by a crane (except on the driver's platform) or ride in a barrow hoist, or in a hod hoist, or adopt other unsafe means of getting about the building, but every such person shall use the gangways, ladders or staircases or other safe means provided for the purpose."

(R. 21.6.1926.)

IRISH FREE STATE

As for *Great Britain*.

LUXEMBURG

"42. All workers employed on a building shall construct with all possible care the scaffolding, staging and gangways to be used by them, and shall examine them before use to see that they are strong enough and that the safety appliances required by the regulations are in place.

43. Workers shall not load scaffolding unevenly or to excess or throw loads on to the scaffolding or jump from upper to lower parts of scaffolding.

44. Standards, ledgers, putlogs, etc., shall be so fixed that they cannot be displaced during the use of the scaffolding.

The distance between the standards shall be fixed according to the load, provided that it shall not be more than 2.50 m.

The wood used for the construction of scaffolding and staging shall be sound, in good condition, without cracks and not weakened by previous use.

45. Trestle scaffolding shall not be erected on an uncovered system of floor joists. Two trestles shall not be placed one upon the other; trestles shall not be placed on barrels, boxes, heaps of bricks, etc.

48. For lashing together parts of scaffolding and for the raising and lowering of loads, only strong hemp or wire ropes not weakened by use shall be used.

49. Building material shall be taken on to the scaffolding with the greatest care in respect of the safety of persons employed in the vicinity.

Tools, materials and other objects intended for use shall be placed on the scaffolding or masonry in such a way that they cannot fall.

Tools, materials and scaffold boards shall not be thrown down from the scaffolding or parts of the building unless a repeated shout of warning has been given.

50. Workers shall not on their own authority remove parts of scaffolding, ladders, stays, staging, rails, safety devices, etc., or make any change in working arrangements.

The head of the building undertaking shall be notified at once of any injury or unusual state of affairs in connection with the plant.

Damaged ladders shall at once be repaired. Measures shall be taken to prevent ladders from swaying, bending, slipping and overturning.

53. In case of frost and ice, sand shall be strewn on the scaffold boards and gangways; this shall also be done on the upper surface of walls when beams are being laid and other carpenter's work carried on.

54. After dark no person shall enter buildings which are not lighted; and no person shall sleep or rest on scaffolding or other dangerous places.

Any worker liable to giddiness or suffering from epilepsy or other infirmity which may entail danger shall inform the employer or foreman thereof.

Workers shall not remain unnecessarily under scaffolding which is being taken down.

56. All workers, especially roofers, chimney builders, plumbers and painters, are especially urged to observe the instructions with regard to safety given them by the employer or foreman, and to use the safety appliances placed at their disposal, such as ropes, belts, ladders, etc.

Workers shall not in any circumstances expose themselves or others to danger by careless or foolhardy action or using tools, machinery and the like which they are not required to use in connection with their own work.

57. Every worker shall at once obey when forbidden by the employer or foreman to remain in a dangerous place or when ordered to leave the building."

(O. 28.8.1924.)

POLAND

"39. (1) Workers employed in building operations shall strictly comply with the provisions of the present Decree.

(2) Workers shall be prohibited from placing loads on scaffolding or other auxiliary or protective devices on their own authority.

(3) Workers shall be prohibited from removing auxiliary or protective devices, or making any alterations in them on their own authority.

(4) When hoisting or lowering suspended scaffolds care shall be taken that the platforms are not excessively inclined.

(5) The wearing of wooden clogs shall be prohibited on ladder scaffolds and in work done on roofs.

(6) Remaining on scaffolds after working hours shall be prohibited, as shall be sleeping on scaffolds . . .

(7) During the erection, dismantling and testing of scaffolds and of all auxiliary and protective installations, the workers shall be prohibited from standing or passing under such installations.

(8) The workers shall not use devices, mechanical equipment, electrical conductors, etc., with which they are not concerned.

(9) The workers shall be bound to inform the person in charge immediately of any damage to auxiliary or protective installations, or to any other installations, devices and tools used in the work."

(O. 23.5.1935.)

SWITZERLAND

Geneva

"10. In their own interests employees shall take the measures prescribed to them for the prevention of accidents, use the protective devices provided for them and observe strictly all the provisions of these Regulations. They are expressly recommended to take of their own accord all urgent safety measures which prudence and experience in their occupation suggest to them.

13. Employees shall not jump across the open space between a window or a wall and a scaffold or between two scaffolds.

14. Employees shall not wear clogs when working at the construction of scaffolds, on roofs or in any other dangerous place.

15. If employees must remove certain parts of a scaffold (railings, staging, etc.) for particular work, they shall replace such parts immediately.

18. Employees shall not take their meals or rest in dangerous places, nor hang up their clothing therein."

(R. 25.3.1930.)

CZECHOSLOVAKIA

" 85. (1) Every worker on entering employment shall have his attention drawn to the following regulations, which shall be affixed permanently and kept in thoroughly legible condition at one place accessible to everybody or at several places in the constructional workplace. The special attention of every worker shall be drawn on his entrance into employment to the provisions of subsection (1) of section 93 respecting the notification of accidents.

86. (1) Workers shall be bound to erect scaffolding with the greatest care and to test the stability and protective devices thereof before use, in particular after long interruptions of work, storms, high wind or prolonged rainy weather.

(2) When scaffolds are being erected or demolished, workers shall not remain underneath them unnecessarily.

(3) Tools, timber, bricks, stones or other heavy objects shall not be thrown down from a scaffold or elsewhere in a building on to any place which is not fenced or specially guarded. Further, it shall not be lawful to load a scaffold unequally and in a manner unsuited to its carrying capacity and type of construction, or to jump on to lower scaffolds or newly-built concrete ceilings or arches or throw heavy objects down upon them.

(4) Nails projecting from scaffold materials and implements shall immediately be removed or properly hammered down.

(5) Scaffolds shall not be anchored to gutters, rain pipes, window frames, lightning conductors and other insecure objects.

(6) Loose bricks piled together, barrels, boxes and similar objects shall not be used as a base for standards, uprights, trestles, ledgers, etc.

(7) Cramps shall be loosened in such a manner that they neither jump nor fly off. Cramps, screws and similar objects shall not be thrown up or down during the erection or demolition of scaffolds.

(8) When a scaffold is being erected or demolished, ladders shall be secured so that they do not overbalance, and shall always be placed on a firm base. Damaged ladders shall not be used.

(9) Parts of scaffolds, ladders, uprights, girders, cramps, trestles, covers, etc., shall not be removed, and constructional arrangements shall not be altered, without authority.

(10) In the hoisting and lowering of suspended scaffolds, the winches shall be wound evenly, so as to avoid the tilting of the platform. When not in use, the crank handles of the winches shall be rendered immovable or removed.

(11) Workers shall not remain on scaffolds—except high tower scaffolds and works chimney scaffolds—during the midday interval.

(12) Workers shall not remain under openings in scaffolds made for goods hoists while the said hoists are in use. The hoist well shall be completely shut off while the hoist is out of order.

88. (1)

(2) Climbing on scaffolds, ropes, chains, uprights, etc., shall be prohibited.

(3) Workers shall not stand during work on cans, boxes and similar unstable and unsafe objects.

90. (2) When engaged in dangerous work, in particular in roofing, removing snow, cleaning windows, fixing lightning conductors, certain plumbing, glazing and painting work, building factory chimneys, erecting lofty iron

structures and similar work, workers shall make use of the safety belts and ropes provided for them. In default of a special fitting on the roof for fastening such ropes, they shall be securely fastened to the usual ladder scaffold.

(3) Only shoes with soft soles or shoes wrapped in cloth shall be worn during work on a roof.

91.

(3) When erecting scaffolding, workers shall not wear wooden shoes or clogs.

(4) Workers shall not go about a constructional workplace barefoot.

(5) During glazed or ordinary frost, access to scaffolds, gangways, stairs and similar places and tops of walls shall not be allowed until they have been sprinkled with sand or similar substances or otherwise rendered safe for walking. Ladders shall always be freed from ice and snow.

92. (1) All damage and every noteworthy occurrence to the constructional plant shall be reported forthwith to the person responsible to the contractor for the supervision thereof.

(2) The plant and protective devices shall not be put to any use other than that for which they are intended, and shall not be removed without authority or damaged.

(3) Workers shall not alter or repair any appliance, electrical conductor, machinery or the like, the minding, use or maintenance of which is not a part of their duties. Workers shall not endanger themselves or others by using anything in a manner contrary to the purposes of the constructional work or by practical joking, teasing, quarrelling or other wilful acts.

(4) Every worker shall endeavour in his own interests to avert impending injury or danger from his fellow-workers and other persons.

(5) The workplaces shall be entered and left exclusively by the ways, entrances and exits specified for the said purposes. Unauthorised persons shall not enter any place where machinery is housed.

93. (1) Every industrial accident shall be reported forthwith to the inspection authority by the injured person or, if he is unable so to do, by the witnesses of the accident. The injured person shall abstain from further work until at least a suitable temporary dressing has been applied to the injury."

(O. 26.3.1931.)

YUGOSLAVIA

" 133. *Rules for workers.* The following rules shall be binding on workers employed in building, and shall be affixed conspicuously as such at every building workplace, where possible:

(1) Tools, materials, and heavy objects in general shall not be thrown down from scaffolding or high places about the building.

(2) Workers shall not make alterations in the scaffolding, the arrangement of the ladders, or the arrangements for building in general, on their own authority.

(3) Workers shall exercise care in ascending scaffolding and ladders, and in remaining and going to and fro thereon, in order to avoid endangering their stability.

(4) Breaks shall not be spent on the scaffolding.

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(7) Workers engaged in the work mentioned in section 129¹ shall use the safety belt and rope.

¹ See under § 7 (b) " Safety Belts and Life Lines ".

They shall also observe all the precautions prescribed in these Regulations.

- (8) Workers shall notify the competent supervising authority forthwith of every irregularity noticed in connection with building work.
- (9) Building installations shall not be used for any other purpose than that for which they are intended."

(R. 25.10.1921.)

(e) POSTING UP, ETC., OF REGULATIONS

GERMANY

The relevant safety regulations must be handed to the representatives of the employer (managers, foremen, etc.) and of the workers.

In every case of new construction and of extensive alterations, a relevant extract of the regulations must be posted up conspicuously at a suitable place in every workshop or workplace.

(R. 1.1.1930, sec. 3.)

AUSTRALIA

Queensland

Every owner of scaffolding must have affixed and maintained in such place or places as the inspector directs the prescribed abstracts of the regulations.

(A. 22.12.1915, sec. 19.)

Western Australia

Similar to *Queensland*.

BELGIUM

Employers must keep at the disposal of their workers a copy of the Order of 31 March 1905 and the general regulations together with an extract of the Act of 5 May 1888 concerning the inspection of dangerous, unhealthy or noxious undertakings and the supervision of steam engines and boilers.

(R.O. 31.3.1905, sec. 20.)

BULGARIA

The undertaking's rules approved by the Labour Inspector must be conspicuously displayed.

(O. 4.5.1935, sec. 17.)

FINLAND

The regulations must be affixed in the messroom at the workplace, or in default of a messroom, at the workplace or the most suitable place under the care of the person in charge of the work.

(Res. 15.11.1927, sec. 36.)

FRANCE

In fixed workplaces an extract from the regulations worded as decided by ministerial decree must be posted up in the workmen's shelter and also at the place where the workers are paid.

(D. 9.8.1925/26.11.1934, sec. 60.)

GREAT BRITAIN

Printed copies of all regulations for the time being in force under the Factory and Workshop Act must be posted up in legible characters in conspicuous places where they may be conveniently read by the persons employed. A printed copy of all such regulations must be given on request by the occupier to any person affected by them.

(A. 17.8.1901, sec. 86.)

LUXEMBURG

The regulations must be posted up at suitable points in every place where building work is being carried on, and kept in a legible condition.

(O. 28.8.1924, sec. 58.)

POLAND

The working rules provided for in the Statutory Regulations must be posted up in a conspicuous place.

(D. 23.5.1935, sec. 36.)

SWITZERLAND

Geneva

The regulations must be placed at the disposal of the workers on every building under construction.

(R. 25.3.1930, sec. 168.)

Zurich

The regulations must be affixed in poster form at a conspicuous place on every building under construction.

(R. 31.1.1931, sec. 88.)

CHAPTER II

HOISTING APPLIANCES

§ 1. — Materials and Construction

(a) GENERAL AND MISCELLANEOUS RULES

GERMANY

“ 138

5. All driving gear, ropes and chains shall have a safety factor of 8 based on the total load.

6. Lifting appliances with a crank drive shall be fitted with a disconnectable shaft or with a safety crank and efficient locking device which shall be applied when the machine is in operation, unless it is self-locking. If the load is lowered by gravity, a reliable brake shall be provided.

7. Winding equipment, except rack and pinion winches, shall be fitted with reliable brakes. Hand winches fitted with dead weight brakes shall be so constructed and operated that the crank handle cannot fly back and does not move when the load is being lowered. Removable crank handles shall be secured against inadvertent removal.

8. Devices for disconnecting the drive or for changing the speed shall be so constructed as to prevent inadvertent alteration.

9. The operating speed shall not exceed 1.50 m. per second.”

(R. 1.1.1930.)

“ 1. All lifting appliances shall bear the name and address of the builder and an indication of the year in which they were built.

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Winches

3. The maximum permissible load shall be clearly indicated on all winches.

4. (1) Hand winches shall be so constructed as to prevent any running back when the load is being hoisted. Pawls shall be fitted. It shall not be possible for the crank to turn freely when the load is being lowered. Exceptions may be made in cases where the crank must be reversed by hand in order to place the load exactly in position (forming, assembling, etc.).

(2) Winches, with the exception of rack and pinion winches and self-locking worm-gearred winches shall be fitted with reliable brakes.

(3) Ratchet wheels shall be fitted on the drum shaft or on some other shaft that cannot be disconnected from it. The locking device shall not be made of cast iron, and shall be so constructed, that when the pawl has been applied, the crank handle cannot fly back more than 60°. The pawl shall be within easy reach from the crank handle.

(4) The handles of brake levers shall be so placed that they can be reached without bending.

(5) Removable crank handles shall be secured against being removed inadvertently.

5. Measures shall be taken to ensure that ropes cannot slip sideways off the winding drum. The rope shall be securely fixed to the drum.

6. Steam winches shall be so constructed as to exclude the possibility of anyone being scalded by water or steam. The exhaust pipes shall be so placed that the steam cannot obstruct the field of vision of the winchmen.

7. Mechanism for changing the speed of hoisting shall be protected against the risk of any inadvertent change of speed.

Pulley Blocks

8. Except in the case of rope pulley blocks, the maximum permissible load shall be clearly indicated on pulley blocks.

9. Nuts on suspension and carrying hooks shall be secured against loosening. Flattening of the screw threads shall not be sufficient.

10. (1) Electric pulley blocks shall be so constructed as to ensure automatic disconnection at the highest position of the load. This automatic disconnection shall be used as an emergency control and not as a normal operative control.

(2) Control chains and cords shall be fitted with insulators. The control chains and cords shall be taut over the handles so that they cannot become entangled."

(R. 1.4.1934, Appendix 2 (h).)

ARGENTINA

" 75. Lifts, hoists, and cranes shall offer sufficient guarantees of solidity "

(D. 14.1.1916.)

AUSTRALIA

New South Wales

Builders' Hoists: General.

" (5)

(b) Every hoist shall have legibly painted, and kept so painted on it, a number for purposes of identification and record."

(R. 17.9.1929.)

Queensland

Rope Drums

" (20) (i) The diameters of the drums used shall be not less than those given in the following table for speeds not exceeding 120 ft. per minute:

MINIMUM DRUM DIAMETER (D = diameter of rope)

$$\frac{4 \times 37}{20 D}$$

$$\frac{6 \times 19}{23 D}$$

$$\frac{6 \times 24}{19 D}$$

$$\frac{6 \times 37}{16\frac{1}{2} D}$$

For each increase in speed of 60 feet per minute 2 D shall be added to the diameter for the drum.

(ii) Rope drums for power cranes or hoists shall be machine-grooved, and the contour at the bottom of grooves shall be circular over an angle of

120 degrees. The radius of the groove shall be larger than the radius of the rope by the following amounts:

	Minimum (inches)
For ropes up to and including 2 in. circumference	1/32
" " of 2 1/8 to 2 3/4 in. circumference, inclusive	3/64
" " " 3 to 3 1/2 in. circumference, inclusive	1/16
" " " 3 3/4 in. circumference and larger	3/32

Grooving shall be smoothly finished, and be free from surface defects liable to injure the rope.

(iii) The grooves on the barrel shall be so pitched that there is a clearance of not less than 1/16 in. between neighbouring turns of rope.

(iv) Rope anchorages shall be readily accessible, and if the rope is wound on the barrel in more than one layer the anchorage shall be located clear of the winding, preferably outside the flanges.

(v) The angle between the rope and a plane perpendicular to the axis of the barrel shall not exceed 5 degrees.

The provisions of paragraphs (ii) and (iii) of this clause shall not apply to drums on which overlapping of the rope occurs.

Rope Pulleys

(21) (i) The diameter of lifting-rope and derricking-rope pulleys at the bottom of the groove shall be not less than that of the drums as specified in paragraph (i) of sub-clause 20 hereof.

(ii) Rope pulleys shall be machine-grooved to a depth not less than one and a-half times the diameter of the rope.

The contour at the bottom of the groove shall be circular over an angle of 120 degrees. The radius of this part of the groove shall be larger than the radius of the rope by the amount laid down in paragraph (ii) of the preceding clause.

Grooving shall be smoothly finished, and be free from surface defects liable to injure the rope.

(iii) Pulleys, where difficult of access, shall be of a self-oiling type.

(iv) Pulleys carrying ropes that are periodically unloaded shall be provided with guards to retain the ropes in the grooves.

(v) The angle between the rope and a plane perpendicular to the axis of the pulley shall not exceed 5 degrees.

(vi) Guide pulleys or rollers shall be fitted on the jib and other parts of the structure, where required, for the purpose of preventing chafing of the ropes.

Lifting Hooks

(22) (a) Hooks shall be forged of mild steel (Class B., Specification No. 8, B.S. Report No. 24), or Best Yorkshire Iron (B.S.S. No. 51). When made of steel they shall be normalised. For the purposes of these regulations, normalising shall mean heating a steel (however previously treated) to a temperature exceeding its upper critical range, and allowing it to cool freely in the air. It is desirable that the temperature of the steel shall be maintained for about fifteen minutes, and shall not exceed the upper limit of the critical range by more than 50 degrees C. (90 degrees F.). (See B.S.S. No. 5007-1924.)

(b) Hooks shall rotate upon dust-proof and water-proof ball or roller bearings, and shall be fitted with safety attachments when required.

(c) The dimensions of the hooks shall be not less than those laid down in Form B. 7.¹

¹ Not reproduced.

(d) Hooks shall be tested by the application of twice the full load when no permanent set shall occur. If of mild steel they shall be again normalised after the test.

(e) The safe working load shall be legibly stamped on a non-vital part of each hook, and a test certificate shall be supplied.

Shackles

(23) (a) Shackles shall be forged of mild steel (Class B, Specification No. 8, B.S. Report No. 24), or Best Yorkshire Iron (B.S.S. No. 51), and when made of steel they shall be normalised.

(b) Except when used in conjunction with grabs, shackles shall be of the bolt and nut type.

(c) Shackles when used in straight line work shall be tested to twice the maximum rated load to which they are to be subjected under service conditions; when used eccentrically they shall be tested with a direct pull of three times the maximum rated load to which they will be subjected under service conditions. Shackles, if of mild steel, shall be again normalised after the application of the load.

(d) Each shackle shall be legibly stamped on a non-vital part with an identification number, and the pin of the shackle shall bear the same number.

(e) The safe working load shall be legibly stamped on a non-vital part of each shackle, and a test certificate shall be supplied.

Rigging Screws or Turn-buckles

(24) (a) Turn-buckles shall be forged of mild steel (Class B, Specification No. 8, B.S. Report No. 24).

(b) Turn-buckles shall be of the double-ended screw type, and only shackle or loop attachments shall be used. The screw threads shall be of the square or buttress type, and the length of each internally-threaded part shall be not less than two and a-half times the diameter of the tightening screw.

(c) Turn-buckles, together with their pins and shackles, shall be tested to twice the maximum rated load to which they will be subjected under service conditions.

(d) Each turn-buckle shall be legibly stamped on a non-vital part with an identification number, and its pins and shackles shall bear the same number.

(e) The safe working load shall be legibly stamped on a non-vital part of each turn-buckle, and a test certificate shall be supplied."

(R. 24.12.1930.)

BELGIUM

"2. Hoisting appliances shall be constructed of materials of good quality and sufficient breaking strength.

They shall be erected in such a manner as to ensure their perfect stability under all loading and working conditions.

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4. If the accidental descent of the load or the transporting gear is liable to expose any person to danger, the hoisting apparatus shall be fitted with brakes, pawls, catches or other safety devices arranged in such a manner as to prevent such descents or to limit them sufficiently to eliminate the danger.

If overwinding of the suspension gear is likely to be a cause of danger to the employees, the hoisting apparatus shall be fitted with a device to prevent such overwinding and to apply the brakes automatically as soon as the lift exceeds the permissible limit."

(R.O. 20.2.1933.)

CANADA

Alberta

"(166) In the erection, alteration, repair, improvement or demolition of any building, no . . . hoists . . . or other mechanical and temporary contrivances shall be used which are unsafe, unsuitable or improper, or which are not so constructed, protected, placed and operated as to afford reasonable safety from accident to persons employed or engaged upon the building or excavation."

(R. 1928.)

UNITED STATES

California

"Order 1157. *Safety Hooks.* (a) No open hook shall be used with a bucket, cage or skip in hoisting, but some approved form of safety hook or shackle hook shall be used."

(G.O. 1.7.1926.)

Ohio

"Section 101. Construction elevators, material hoists, towers, masts, derricks or cranes, not constructed as provided in Sections 117, 130 and 131,¹ and all other hoisting devices and all the equipment thereof, shall be of such material, construction and anchorage as is necessary to carry the maximum working loads imposed upon them including wind pressure, calculated on a basis of 20 lbs. per square foot, in such a manner that the allowable working stresses specified in sections 22² and 23³ will not be exceeded. They shall be erected in a substantial manner and securely held in place.

Section 115. No open hook shall be used with a bucket, cage or skip when operated inside of shafts or towers. Some efficient form of safety hook or shackle shall be used or the hook properly housed."

(S.R. March 1931.)

FINLAND

"30. . . . Lifting apparatus shall be provided with efficient catches and brakes. If lifting apparatus has a change-speed gear, any accidental change shall be prevented by means of a safety catch."

(Res. 15.11.1927.)

FRANCE

"2. The material used in the workplaces for scaffolding, ladders, gangways, appliances for hoisting and handling, and all other mechanism and installations shall be strong enough to bear the loads and stresses to which it will be subjected. It shall be tested before use.

The employer shall provide at the workplace itself, or, if this is not possible, at the Head Office of the undertaking, a register in which workers may enter any observations they may wish to make concerning the condition of the material or the presence of any cause liable to impair its strength and, in general, concerning the observance by the employer of the provisions of the present decree.

This register, in which the employer also may enter his observations, shall be submitted to the factory inspector at each of his visits, and signed by him.

5. All hoisting and handling appliances worked by mechanical means shall be provided with a brake or some equally effective device capable of

¹ See under § 2 (b) "Hoist Towers and Framework".

² See under Chap. I., § 1 (c) "Scaffold Materials and Construction".

³ Specifications not reproduced.

stopping the movement in any position, and so constructed that it can function automatically or can be operated immediately by the person controlling the appliance, from the place where he is stationed, even if the motive power is cut off.

Jacks shall be so arranged as to prevent accidents due to the crank swinging back.

9. Hand winches shall be provided with a catch and a brake, or some other device enabling them to be stopped immediately."

(D. 9.8.1925/26.11.1934.)

GREAT BRITAIN

"4. The working gear and the anchoring and fixing appliances of every crane, crab and winch and of all other hoisting machines and tackle shall (a) be of good mechanical construction, sound material, adequate strength and substance and free from patent defect, (b) be kept in good repair and in good working order, (c) as far as the construction permits be examined in position at least once in every week by the driver or other competent person. The results of every such examination shall be entered forthwith in the prescribed Register.

10. (a) Every crane, crab and winch shall be provided with an efficient brake or brakes.

(b) Every part of the framework of every crab or winch, including the bearers, shall be of metal."

(R. 30.9.1931.)

IRISH FREE STATE

"35.

Every hoisting machine, and all tackle, or apparatus, and all appliances connected therewith, shall be of good mechanical construction, sound material, and of adequate substance and shall be properly and securely fixed and of suitable strength."

(R. 5.3.1930.)

ITALY

"2. Provisional installations, besides corresponding to and being suited to the purpose for which they are built, shall be constructed with appropriate materials and in accordance with all technical rules. They shall be kept in perfect condition, as regards working and strength, throughout the period of operations.

This provision shall apply to all mechanical appliances, equipment and accessories.

(R.D. 27.5.1900.)

9.

Lifting appliances shall be fitted with a brake, pawl or other device capable of preventing the load being lowered accidentally. The construction and installation of such appliances shall be such as to ensure perfect stability."

(M.C. 9.9.1925.)

LUXEMBURG

"23.

A movable jib fixed to an isolated standard or a scaffolding standard shall not be used as a lifting apparatus.

24. . . . winches shall be provided with pawls and a brake."

(O. 28.8.1924.)

POLAND

“2. (1) The auxiliary installations, transport installations, protective installations, and hoisting appliances as well as the materials employed in the construction of such installations shall be in conformity with the general practice so far as concerns their nature, and with the prescribed standards so far as concerns their strength.

(2) When use is made during building operations of auxiliary installations of complex construction, that are intended to bear considerable loads at the request of the competent building authority, the plan of the installations accompanied by the corresponding static calculations shall be submitted. The calculations shall be based on the actual loads anticipated during the work. All the moving parts of hoisting appliances (e.g. toothed wheels, drums, and shafts) shall be calculated with a safety co-efficient of 5 based on the maximum loads to be borne; and ropes and chains with a safety co-efficient of 10.

(3) Used materials that are in a satisfactory condition may be employed in the construction of the auxiliary installations, but for the purposes of the static calculations the permissible stresses shall be reduced accordingly.

24. (1) On every hoisting appliance the maximum safe load shall be marked at a conspicuous place. Hoists and cranes shall be marked in addition with the name of the maker and the date of manufacture. Hoists shall also bear a notice stating whether they may or may not be used for the transport of persons.

(2) Hoisting appliances shall be adapted to the scaffolds in such a manner that the safety of the workers employed on them is not endangered while loads are being raised or lowered.

(3) The hoisting mechanism shall be placed at such distance from the load that in the case of the breakage of a part the load cannot fall on the workers attending to the hoisting appliance.

(4) It shall be prohibited to load hoisting appliances hoists and cranes beyond the safe maximum.

25. (1) Hoisting appliances, with the exception of pulleys and pulley blocks, shall be provided with hand or automatic brakes. Access to the brake shall be easy and shall not expose the worker to the risk of injury from the revolving parts of the appliance.

(2) The handle of handle-operated hoisting appliances shall be free, that is, shall not move during the descent of the load; further, such appliances shall be provided with a pawl and ratchet wheel.

(3) Any dangerous parts of friction wheels, toothed wheels or transmission pulleys shall be covered by fencing.

(4) Electric or belt-driven hoisting appliances shall be provided with a device that stops them at the limits of travel.

(5) The change-speed gear shall be such that the speed cannot be changed inadvertently.

(6) Hoisting appliances shall not be cleaned or greased while in motion.”

(D. 23.5.1935.)

SWITZERLAND

Geneva

“115. All lifting appliances, that is, winches, cranes, shear-legs, gin poles, overhead travelling cranes, etc., shall be kept in a perfect state of repair, failing which the competent departments may forbid their use.

116. When acquiring new appliances, the buyer shall satisfy himself that they comply with the regulations concerning accident prevention and shall see that all the safety devices are included in the appliance delivered.

117. All necessary precautions shall be taken to ensure that no accidents occur when lifting appliances are being assembled or taken to pieces.

If scaffolding is necessary this shall be solidly built, well braced and guyed.

126. Lifting appliances shall be fitted with at least one serviceable brake or other equivalent device capable of arresting the movement of the load in every position and so constructed as to work automatically or to be worked by the operator even if the driving power is cut off.

When the load is to be lowered with the winch running light, the winding drum and the driving shaft shall be disconnected by means of a counterbalanced lever."

(R. 25.3.1930.)

CZECHOSLOVAKIA

" 46. (1) Suitable hoisting apparatus (lifts, cranes, differential pulleys, etc.) and reliable scaffolding shall be used for lifting heavy loads. Loads the weight of which exceeds three quintals shall not be raised by a rope on a gin-block or a slewing crane attached to single scaffold poles."

(O. 26.3.1931.)

(b) CRANES AND DERRICKS

GERMANY

" 146. 1. On electric overhead travelling cranes automatic limit switches shall be provided for both lifting and travelling.

Mechanically-driven travelling cranes shall be provided with devices for disengaging the drive at the terminal points.

2. Travelling winches and cranes shall be secured against inadvertent starting and overrunning.

3. The rails along which cranes move shall be inspected as to safety at least once a day before each shift goes on duty."

(R. 1.1.1930.)

Cranes: General

" 11. Cranes shall be constructed in accordance with recognised technical rules.

12. The maximum permissible working load shall be clearly indicated. (Cf. sections 99 and 100).¹

13. The materials, construction and calculation of the carrying parts shall conform to the recognised technical rules.

14. It shall be possible to reach and use the greasing places without risk.

15. (1) Hoisting gear shall be fitted with brakes which can be worked from the attendant's stand.

(2) Appliances used for lifting molten materials shall be fitted with two brakes, either of which shall be strong enough to hold the entire load.

16. Precautions shall be taken to ensure that brake weights cannot fall, e.g. by means of screw-bolts or chains. Fastening by set screws alone shall not suffice.

17. Overhung brake discs shall only be used if they are specially secured against failing.

Hand-driven Cranes

18. Sections 4, 5 and 9 ² above shall apply *mutatis mutandis* to hand-driven cranes.

¹ See under § 5 (e) "Overloading; Indication of Maximum Load".

² See under § 1 (a) "Materials and Construction: General and Miscellaneous Rules".

19. Strong and well secured buffers shall be fitted at the ends of crane and crab rails.

20. Before use new cranes shall be tested both at rest and in motion with a load 25 per cent. more than the maximum load indicated on the crane.

Power-driven Cranes: General

Construction of the crane.

21. The dimensions of the winding drum shall be such that the rope can be wound in a single layer. When the hook is at its lowest point there shall be at least one and a half turns of rope left on the drum.

22. Winding drums shall be fitted at both ends with flanges projecting at least two and a half times the diameter of the rope. Only if other adequate precautions are taken to ensure that even in exceptional cases the rope cannot slip into the toothed gear, can a flange be dispensed with on the safe side of the drum. In special types of crane, provided that the condition mentioned above is fulfilled, drums need not be fitted with flanges on either side.

23. In the case of cranes used for hoisting molten materials, the pulley blocks shall be protected against the radiated heat.

24. In the case of electric cranes, the lift shall be limited by an emergency switch (limit switch) or else braking haulks or reliable safety catches shall be fitted. This shall not apply to cable-way cranes.

“ 26. In the case of steam cranes, the exhaust pipes shall be so placed that the steam cannot obstruct the field of vision of the crane driver.

Jib Cranes

101. Unless there are constructional or working difficulties in the way, jib cranes shall be provided with safety devices against overturning. As such shall be considered, for example, rail-tongs, propping devices, retaining hooks, bolt attachments and, in the case of electrically-driven cranes, overload circuit breakers or lifting rollers.

104. (1) Cranes shall be so constructed that persons cannot be crushed between the revolving supporting structure of the jib and the driver's stand. In particular, in the case of cranes which run on rails precautions shall be taken that prevent crushing between the driver's cab and the stop baulks or buffers.

(2) Cranes that are intended to be coupled with other vehicles shall be equipped only with draw hooks. Suspension devices shall be prohibited.

105. It shall be possible to reach the rope pulleys at the end of the jib by a ladder that is protected at the sides against falls.

107. Cranes running on the ground shall be provided with rail-guards and loud warning devices. The warning devices shall be so installed that they can be made to work automatically.”

(C.R. 1.4.1934, Appendix, 2 (h).)

AUSTRALIA

New South Wales

Hand Cranes

“ 14.

Each back-stay of any crane shall be loaded with a weight equal to at least three times that which the crane has to lift.

All pawls must be provided with efficient locks to prevent pawls inadvertently getting out of engagement.

Faces of ratchets, clutches, gearlocks, and collars to be kept square.

Band-brake to be kept in efficient condition.

All handles to be kept in position with nuts, proper pins, or cottars.

Wheels and pinions to be kept in good condition, properly keyed up and in gear relation. Wheels and pinions with broken teeth to be discarded and replaced; pegs or dove-tailed teeth will not be allowed.

All spliced eyes to be round thimbles, and to have not less than three full tucks.

Sole-plate of crane to be properly bedded level, and precaution to be taken against skidding.

.....

Steam Cranes and Steam Hoists

15. The boilers of steam cranes and steam hoists must be provided with the following fittings, which must be to the approval of the inspector: Safety valve, stop valve (fitted either directly to a seating upon the boiler shell or to safety-valve casting), 2 test cocks, approved pressure gauge, water gauge, blow-off cock, injector or inspirator or feed pump, and a fusible plug fitted to the furnace crown.

16. All pawls must be provided with efficient locks, to prevent pawls inadvertently getting out of engagement.

Faces of ratchets, clutches, gearlocks and collars to be kept square, and locks engaging collars to be kept a good fit.

Metal band-break to be kept in efficient condition.

All handles to be kept in position with nuts or proper pins or cottars, and clutch levers to be locked in position in or out of engagement.

Wheels and pinions to be kept in good condition, properly keyed up and in correct gear relation. Wheels and pinions with broken teeth to be discarded and replaced; pegs or dovetailed teeth will not be allowed.

All spliced eyes to be round thimbles and to have not less than three full tucks.

Sole-plate of crane to be securely and properly bedded level.

.....

No crane that is primarily intended for hand power will be allowed to operate by mechanical power, unless the speed is kept within the maximum speed that could be obtained under ordinary conditions by hand; the load under any circumstances not to exceed that for which the crane was designed.

.....

Derricks

19. All single mast derricks shall be provided with not less than three guys; "Yankee Derricks", or other similar contrivances, shall have not less than one front guy and two back guys. All guys must be securely attached to top of derricks and fastened to substantial anchorages."

(A. 26.11.1912, Schedule.)

Queensland

CRANES AND HOISTS

Application

" 15. (1) This Regulation shall apply to cranes and hoists whether driven by hand or mechanical power.

.....

Service Conditions

(3) The crane or hoist shall be deemed to be under service conditions when it is handling any load up to the maximum for which it has been designed—

that is to say, when it is lifting or lowering the load and (or) the jib, and (or) is slewing in either direction, and when it is being subjected to the stress resulting from acceleration, retardation, impact, and wind pressure, computed in the manner hereinafter described.

Load

(4) The crane or hoist shall be so designed and constructed that when it is working under service conditions the stress induced in any part shall not exceed the breaking load of the material divided by the factor of safety herein specified or the maximum, specified hereinafter.

The crane or hoist shall bear a legible and permanent inscription naming the length of the jib, the maximum load, and the radius appropriate thereto.

For cranes or hoists of variable radius clear indication of the permissible loads shall be given by means of an automatic radius indicator and a safe load indicator and (or) table.

When change speed gear is used on the lifting motion, the maximum load and speed for each lift shall be similarly indicated.

Factor of Safety

(5) For the purpose of this Regulation the factor of safety shall be determined by dividing the lowest ultimate strength of the material by the computed stress from all causes when the crane or hoist is working under service conditions as defined in clause (3).

All parts of the crane or hoist shall have a minimum factor of safety of 5 under service conditions.

This clause shall not apply to struts and wire ropes, which are dealt with in clauses (14) and (19), respectively.

Impact

(6) In a calculation of stresses induced by the maximum rated load in any part of the crane or hoist, 20 per cent. shall be added to the maximum rated load on the hook, as an allowance for shocks under service conditions.

This clause shall not apply to wire ropes which are dealt with in clause (19).

Slewing Speeds

(7) The slewing speed at the jib head shall not exceed 400 feet per minute. For purposes of calculation the acceleration and retardation of the slewing motion shall be assumed to be not less than 2 ft. per second at the jib head.

The provisions of this clause shall not apply to cranes or hoists in which the slewing is manually operated.

Wind

(8) The crane or hoist shall be designed and constructed for operating under a steady wind pressure of 5 lb. per square foot.

When at rest under storm conditions, the crane or hoist shall be capable of withstanding a steady wind pressure of 35 lb. per square foot.

The calculation in both cases shall be made on an area equivalent to one and a half times the projected area except for cabins, machinery houses, and other single surfaces, where the projected area only shall be taken.

Stability

(9) (a) The anchoring and (or) ballasting of the crane or hoist shall be such as to ensure that with the jib in any position the righting moment will be at least 60 per cent. greater than the overturning moment imposed under the following conditions, whichever shall be the more onerous:

- (i) The crane or hoist at work under the joint influence of the maximum rated load at the appropriate radius, impact, inertia, and the maximum wind pressure allowable;

- (ii) The crane or hoist at rest and subjected to the wind pressure specified in clause (8).

(b) Bolts securing the crane or hoist to each of its anchorages shall be of such number and length, and be arranged in such a manner that the anchorage shall be permanently available for stability. The pull on the anchorage shall applied symmetrically at the junctions of backstays with sleepers.

Means shall be provided to prevent the heel-pin at the foot of the mast leaving its socket under service conditions.

The provisions of this paragraph shall not apply to the Guy Derrick type of crane.

.....

Jibs

(11) It shall be assumed that the jib will be loaded with a horizontal force, acting along the axis of the jib-head sheave pin in either direction, equal to one-sixteenth of the maximum rated load, as an allowance for inertia and the resulting swing of the load during slewing, and in the making of inclined lifts, and the jib attachment shall be designed to withstand this horizontal force. The jib-feet and the members by which they are connected to the mast shall be of steel.

Bolts and Set Screws other than those used in Crane or Hoist Structure

(12) Bolts and set screws shall be locked; but this provision shall not apply to set screws used for locking purposes. The stress on the net section of a bolt or setscrew shall not exceed 3 tons per square inch for steel or $2\frac{1}{2}$ tons per square inch for wrought iron (See clause 17).

Back Stays

(13) Wherever possible back stays shall be designed with attachments concentric with their axes. Where this cannot be arranged, and bent glau iron or similar eccentric attachments are used, the bending stresses due to eccentricity shall be taken into consideration in the design of attachments and back stays.

The derricking-ropes and (or) rods shall be arranged so as to be clear of the structure for all erecting and working positions of the jib.

The requirements of this clause shall not apply to the Guy Derrick type of crane.

Struts, including Jibs and Back Stays

(14) In no case shall the slenderness ratio $\frac{l}{r}$ of any strut member exceed 80, l being the full length of the strut in inches and r the minimum radius of gyration of the central cross section in inches.

For latticed strut members the slenderness ratio $\frac{l}{r}$ shall not exceed 60.

Where a lattice strut is of varying section, and the minimum radius of gyration of the cross section at the quarter point from either end is less than 75 per cent. of r as defined above, the value of r shall be reduced in direct proportion to the deficiency below 75 per cent.

With lattice struts, wherein the main members are stiffened laterally at intervals by bracing, the ratio $\frac{l}{r}$ for any portion into which a main member is divided by the latticing shall not exceed 80 per cent. of its value for the whole strut.

The latticing and plating of a strut-member shall be proportioned to resist the maximum transverse shear at any cross section, such shear being assumed to be divided equally between the parallel planes of bracing concerned; but in no case shall a value be allowed for transverse shear less than $2\frac{1}{2}$ per cent. of the maximum axial load under service conditions, plus the shear at such planes of bracing due to simultaneous transverse loads on the member.

The computed stresses induced in struts under service conditions, including

stresses arising from bending, eccentricity of loading, and the dead weight of the member, shall not exceed $6.5 (1 - 0.005 \frac{l}{r})$ tons per square inch, and in no case shall this stress exceed 5.5 tons per square inch.

The minimum width of lattice bars shall be: $2\frac{1}{2}$ inches for $\frac{7}{8}$ -inch rivets; $2\frac{1}{4}$ inches for $\frac{3}{4}$ inch rivets; 2 inches for $\frac{5}{8}$ -inch rivets.

The minimum thickness of lattice bars shall be not less than one-fortieth of the shortest distance between centres of rivets in the case of single latticing and one-sixtieth of this distance for double latticing, riveted at the intersections.

Rolled sections of equivalent strength may be used instead of flats.

Lattice bars shall be inclined at an angle of about 60 degrees to the axis of the member when single latticing is used, and at an angle of about 45 degrees with double latticing.

The maximum spacing of lattice bars shall be such that the ratio $\frac{l}{r}$ for the portions between consecutive connections of the latticing shall not be greater than 80 per cent. of this ratio for the member as a whole.

Splices

(15) The strength of splices in steel structural members shall be not less than that of the member. Where bolts are used they shall be turned and fitted into reamed holes.

Welding

(16) Welded joints shall not be used in the structure, rigging, or mechanism of the crane or hoist.

.....

Bearings supporting Rotating Parts of Crane or Hoist Structure

(18) Bearings may be of the plain cylindrical type or of the ball or roller type. Irrespective of type, housings, balls, and rollers shall be of steel. When the crane or hoist is supported by a "live ring" the rollers shall be machined to the correct taper, and shall be mounted upon turned-steel pins fitted with grease lubricators of the screw-down type. Bearings of the plain cylindrical type shall be bushed with bronze, white metal, or other anti-friction metal.

.....

Gearing and Pawls

(25) (a) Gearing and pawls shall be of steel, with the following exceptions:

- (i) Pinions, which may be of compressed fabric or of bronze;
- (ii) Friction cone-bevel gears, which may be of cast-iron;
- (iii) Worm-wheels, which may be made with cast-iron centres and phosphor bronze rims.

(b) Key-bosses shall be provided. Keys in gear trains shall be locked so that they cannot work adrift.

(c) Gearing shall be guarded so as to prevent injury to persons and damage by ropes or otherwise.

(d) Where worm-gearing is used it shall, under test, have the same load and time rating as the driving motor, and the maximum temperature rise of the oil bath, when measured by thermometer, shall not exceed 100 degrees F. (56 degrees C.) above the atmosphere.

(e) A slipping device shall be provided on the slewing mechanism of the tower derrick type of crane in order to protect the tower and mechanism from a twisting moment greater than that for which they have been designed.

Brakes

(26) Hoisting-motion brakes under service conditions shall be capable of exerting a restraining torque 50 per cent. greater than the torque transmitted

to the brake-drum from the suspended maximum load, exclusive of the friction in the transmission details between the load and the brake.

The stresses in any part of the brake construction while such restraining torque is being exerted shall not exceed one-half of those allowable for the respective materials.

The temperature of the rubbing surfaces of the brake shall not exceed 212 degrees F. (100 degrees C.) with wood or fabric lining, and 400 degrees F. (204.4 degrees C.) with bonded asbestos or metal lining, after the maximum load has been raised and lowered on the brake five times continuously through the specified lift, the speed of lowering being 50 per cent. greater than that of lifting.

Brakes shall be provided with a simple and accessible device to compensate for the wear of the linings.

Where solenoid brakes are fitted they shall apply the full-braking torque immediately the current is cut off from any cause, even after the lining and fittings have become worn. A dash-pot or the equivalent shall be provided to prevent shock.

The springs of spring-applied brakes shall be fitted in duplicate, and shall not be stressed above 50,000 lbs. per square inch, under maximum-load service conditions. Such springs preferably shall be of the compression type. They shall comply, in all respects, with the requirements of Specifications Nos. 7 and 7 A, British Standard Report No. 24, Part III.

Brake-weights shall be bolted securely to their levers.

The wearing surface of all brake-drums shall be truly circular, smooth and free from defects.

Brake-blocks and linings shall be protected from the action of water.

Brake-linings shall be effectively and permanently secure even after they have become worn.

Where more than one lowering-brake is provided, each brake shall be capable of exerting the full braking torque, as specified above, and the brakes shall be independently operated.

Brakes applied by hand shall not require a force greater than 35 lb. at the handle, and the brakes applied by foot shall not require a force of more than 70 lb. on the pedal.

A locking device shall be provided on a hand-or-foot-operated hoisting-motion brake capable of sustaining 50 per cent. above the maximum rated load.

A slewing-brake shall be fitted in an accessible position, and provision shall be made for it to be secured in the holding position.

Where electric braking is adopted, the conductors and the contact surfaces of the motor and the control gear shall be proportioned in such a manner that the additional duty will not cause them to overheat.

Controls

(27) Controlling hand-levers and pedals shall be placed in positions allowing the attendant ample room for operation and control.

Levers shall be provided with stops and (or) catches to ensure safety and facility of operation. Labels shall be furnished to indicate the use of the controls.

Interlocks

(28) An interlocking arrangement shall be provided between the derricking clutch and the pawl sustaining the derricking barrel."

(R. 24.12.1930.)

AUSTRIA

(c) Cranes and Winches

" 23. Cranes and winches shall be provided with pawls and band brakes, or other reliable braking appliances. If the load is lowered by gravity and the winch has two speeds, a pawl shall be fitted to ensure that the winch does not change automatically into top speed.

Travelling cranes on which workers are employed shall be provided with sufficiently secure and fenced platforms or galleries to exclude any risk of men or materials falling.

The carrying capacity in kilograms shall be clearly indicated on every crane."

(O. 7.2.1907.)

CANADA

Alberta

" (68) *Cranes and derricks.* Factor of safety for all parts other than gears, and complete hoist mechanism, 5.

(69) Factor of safety for brakes is 1.5.

(72) Crane-bumpers shall be provided and shall be at least one-half of the diameter of the truck-wheel in height. Both truck-wheel bumpers and trolley bumpers shall be fastened to the girder and not to the rails.

(74) Access to and exit from the crane-cage shall always be by stationary ladders, stairways, or platforms provided for the purpose. Crane-men shall keep their hands free when going up and down ladders.

(75) Safe means shall be provided for passing from crane-cab to bridge footwalks, and shall consist of fixed ladders or stairs with handrails.

(80) Cranes which are subjected to heat from below shall have a steel plate lined with asbestos and placed six inches (6") below bottom of cage.

(88) All electrically operated cranes shall be equipped with limit switches for the purpose of preventing overwinds.

(89) Where crane-cage is provided with electric heaters or electric lights, the wiring for same shall be run and secured in a regular manner and provided with a fuse and switch.

(90) All exposed metal parts, on electrically operated cranes, and which do not carry current, including handles, conduits, covers, motor-frames, the entire frame of the crane and tracks shall be permanently and effectively grounded.

(91) Blocks shall be constructed so that the cable cannot jump off the sheave.

(92) Gudgeon on top of derrick shall have a forelock to prevent leg-strap from coming off gudgeon.

(95) Hand-winches shall be equipped with dog that will hold load, and dog shall be kept in place while lifting load."

(R. 1928.)

" (8)

(b) A double flooring of two-inch planking shall be laid down immediately under any derrick for a sufficient space about the derrick to protect workmen on the floors below that on which the derrick is working and to hold with safety the materials hoisted by the derrick."

(Revised Statutes 1922, as amended 21.3.1928,
ch. 41.)

UNITED STATES

California

" *Order 1135. Derricks.* (a) Derricks shall be constructed of sound seasoned lumber, with proper iron or steel braces and fittings, or entirely of iron or steel, and shall be of proper strength and size for the work to be performed, and shall be anchored to prevent them from tipping or collapsing.

(b) All hand power derricks shall be equipped with an efficient friction brake and shall be provided with a device of sufficient strength to hold the load in any position."

(G.O. 1.7.1926.)

Ohio

"Section 102. Gin poles, frame derricks and similar hoisting apparatus shall be designed and constructed and have sufficient guy lines to securely support and maintain the maximum working loads to be imposed upon them. Such lines shall be so placed as to prevent excessive swaying and shall be securely fastened to permanent parts of the building where possible, and when fastened to a temporary construction, care shall be taken to see that such temporary construction and fastening is of the proper strength to hold the load. Guy lines shall not be fastened to rolling stock (railroad cars, tracks, etc.) except where the hoisting equipment is mounted as a complete portable unit.

Section 103. The sills of stiff leg derricks shall be substantially secured in such a manner that the derricks will not tip under the maximum working load in any position. Not less than four (4) guy lines shall be used to hold the mast of a guy derrick. Guy lines shall be securely fastened to the permanent construction where possible. Where the boom of a stiff leg or guy derrick is longer than the mast, a holding down guy or other device shall be used to prevent pulling off the top fittings. The foot of the mast shall be set on a substantial foundation and shall be securely fastened in place."

(S.R. March 1931.)

Wisconsin

"Order 3530. *Derricks.* The structural parts of every derrick, such as the footing, mast and boom, shall be designed and constructed as required under Order 3512.¹ The anchorage of the support for a mast or boom shall be such as to prevent slipping or tipping under any load condition.

The connections to masts, booms or other members of a derrick, the making of splices or joints in a member, and similar operations on any part of a derrick, shall be made in a manner which will not reduce the strength and efficiency of such member or part.

The requirements which apply to hoist ropes and cables, fastening of cables, and the size and kind of sheaves under Order 3529² shall also apply to derricks.

Derrick power equipment shall be equipped with brakes, or equivalent devices, which will sustain the load in any position."

(G.O. 15.7.1933.)

FINLAND

"30. Cranes and winches shall be placed on a safe base and anchored or propped so that when in use under load they do not sway and are not displaced. Lifting apparatus shall be provided with efficient catches and brakes. If lifting apparatus has a change-speed gear, any accidental change shall be prevented by means of a safety catch.

Hand cranks of cranes and winches shall be permanently fixed to the shaft.

If a crane is driven by mechanical power, it shall be made possible for the crane driver to watch the load from his place either directly or indirectly throughout the process of transportation. If a crane is driven by electricity, precautions shall be taken against workers coming into contact with the live parts.

Suitable and safe greasing apparatus shall be provided for greasing the parts of the crane situated at a height. Travelling cranes shall be fitted with an apparatus by means of which a signal can be given before the crane is used."

(Res. 15.11.1927.)

¹ See under Chap. I, § 1 (c) "Scaffold Materials and Construction".

² See under § 2 (b) "Hoist Towers, etc."

GREAT BRITAIN

“(5) The requirements of this Regulation shall, except as otherwise specified, apply to all Scotch derrick, guy derrick and tower derrick cranes and to such cranes only.

(a) No crane manufactured after 30 September 1931 shall be used unless it conforms to the standards of strength, stability and safety specified in the British Standard Specification No. 327 of 1930, for derrick cranes or subsequent amendments thereof, and unless a certificate in the prescribed form has been obtained from the makers of the crane certifying that the crane after being tested in accordance with the requirements specified in such specification or subsequent amendments thereof conforms to the said standards. Every such certificate shall specify the safe working loads at various radii of the jib.

Provided that for the purpose of this Regulation any amendment made to the British Standard Specification No. 327 of 1930 requiring a higher standard of strength or stability than is required by the Specification aforesaid shall not apply to any crane manufactured before or within 6 months after the said amendment has been made and published by the British Engineering Standards Association.

(b) No crane manufactured before 1 October 1931 shall be used unless it has been tested and examined by a competent person and a certificate of such test and examination in the prescribed form specifying the safe working loads at various radii of the jib, including the maximum radius at which the jib can be worked, has been obtained from the person who made the test and examination. The safe working load so specified at any radius shall be not more than eighty per cent. of the maximum load which the crane has stood at that radius during the application of the test.

(c) No crane manufactured before 1 October 1931, other than a crane having any timber structural member, shall be used after 31 December 1935 unless it has been brought up to or brought as near as is reasonably practicable to the standards of strength, stability and safety specified in the British Standard Specification No. 327 of 1930 for derrick cranes either by strengthening the working parts or reducing the safe working loads or by such other means as may be most suitable in the particular case, and unless a certificate in the prescribed form specifying the safe working loads has since been obtained in the manner indicated in Regulation 5 (b).

(d) No crane which after the date of these Regulations has been converted from a hand crane to a power crane shall be used unless it has been brought up to or brought as near as is reasonably practicable to the standards of strength, stability and safety specified in the British Standard Specification No. 327 of 1930 for power-driven derrick cranes either by strengthening the working parts or reducing the safe working loads or by such other means as may be most suitable in the particular case, and unless after such conversion it has been tested and examined by a competent person and a certificate of such test and examination in the prescribed form specifying the safe working loads has been obtained in the manner indicated in Regulation 5 (b).

(e) No crane which has any timber structural member shall be used after 31 December 1931 unless (i) it has been examined thoroughly by a competent person within the previous 14 months, (ii) the timber stress-bearing members embedded in metal parts have been completely exposed and examined, and the gland irons have also been examined, by a competent person within the previous two years or such other period as the person who made the last such examination may have directed, and (iii) a certificate of every such examination in the prescribed form has been obtained from the person who made the examination. No such crane shall be used after 31 December 1939.

(f) The maximum radius at which the jib may be worked shall be clearly indicated on the crane and when at this radius there shall be not less than two dead turns of rope on the derricking drum. These requirements shall not apply to a crane which conforms to the British Standard Specification No. 327 of 1930 for derrick cranes or subsequent amendments thereof.

(g) The jib of a Scotch derrick crane shall not be erected between the back stays of the crane.

(h) Where the guys of a guy derrick crane cannot be fixed at approximately equal spacing, such other provisions shall be made as will ensure the safety of the crane.

.....

(j) The whole of the appliances for the anchorage of a crane shall be examined on each occasion before erection, and the erection shall be supervised by a competent person

.....

9.

(b) Every crane having a derricking jib shall be provided with an effective inter-locking arrangement between the derricking clutch and the pawl sustaining the derricking drum, except where the hoisting drum and the derricking drum are independently driven or the mechanism driving the derricking drum is self-locking.

(c) The lever controlling the link-motion reversing gear of every steam crane shall be provided with a suitable spring-locking arrangement."

(R. 30.9.1931.)

IRISH FREE STATE

" 35. Every crane, crab and winch shall be provided with an efficient brake or brakes and shall have the safe working load plainly marked upon it . . .

The lever controlling the link-motion reversing gear of every steam crane shall be provided with a suitable spring-locking arrangement . . ."

(R. 5.3.1930.)

MEXICO

" 516. In the case of cranes driven by electric power, the crane structure, the motor frame and the rails shall be earthed.

517. In the case of travelling cranes operated by ropes or chains from the floor of the premises in which they are situated, the cranes shall bear a clear indication of the various movements that can be imparted to them; they shall be operated only by duly authorised persons with adequate experience of such work.

.....

520. Platforms with guard-rails, and permanently fixed ladders giving access to these platforms shall be provided for the use of workers repairing or greasing cranes or hoists."

(R. 28.11.1934.)

SWITZERLAND

Geneva

" 124. In order to ensure that cranes shall not be moved or overthrown by the wind, they shall be provided with some form of anchorage which shall be used when the cranes are not in operation.

Balance weights shall be placed at the prescribed points and shall bear an indication of the place where they should lie. These weights shall be fastened in such a way as to ensure that they will not fall owing to shocks or unexpected movements of the crane. Balance weights shall not consist of utilisable building materials. A plan showing the position of the balance weights shall be posted up near the driver's stand and their proper weight shall be clearly indicated.

125. In order to ensure that the breaking of a wheel shall not involve the collapse of a crane an iron support which shall be not more than 2 cm. above the rail shall be fitted in front of each wheel."

(R. 25.3.1930.)

CZECHOSLOVAKIA

(c) *Cranes and Winches*

"53. (1) Cranes and winches shall be fitted with a pawl and band brake or other efficient braking device. If the load is lowered by gravity, a falling pawl shall be used in the case of two-speed gears to prevent the automatic engagement of the high-speed gear.

(2) Travelling cranes and slewing cranes on which workers are employed shall be provided with sufficiently safe platforms or galleries fenced all round to prevent persons and materials from falling.

(3) Travelling mast cranes shall be erected on a firm foundation. The horizontal guide rail shall be securely anchored either by oblique tension rods let into the ground or fixed in sufficiently strong parts of the walls of the building. The crane shall be properly tested before being anchored. It shall be operated by a crane driver who is reliable and thoroughly acquainted with the entire apparatus."

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

Travelling Cranes (American Derricks, Wharf Cranes, etc.)

"(h) The counterweight box shall be so constructed that the counterweight cannot fall from the box when the maximum counterweight is being carried."

(O. 5.5.1930, sec. 136.)

Additional Rules for Travelling Wharf Cranes

"(a) Cranes shall not be used unless they are in perfect condition and the counterweight box fully loaded . . ."

(2) The construction, maintenance and testing of steam boilers for driving cranes shall conform to the Regulations concerning the construction, installation, maintenance and testing of steam boilers, steam reheaters and economisers . . ."

(O. 5.5.1930, sec. 137.)

Fixed Cranes of the American Derrick Type

"138. Fixed cranes of the American derrick type shall comply with the following requirements:

(a) The crane shall rest on a solid foundation, the strength of which has been calculated for the maximum load.

(b) The upper part of the mast shall be strengthened by struts (rigid derricks) or by flexible bracing (guy derricks). The lower ends of the struts or guy ropes shall be anchored to the ground by plates weighted with stones to the necessary extent or otherwise anchored by some thoroughly reliable method.

(c) The mast shall be fitted with cross-bars that can be used as a ladder for inspecting and oiling the head of the mast, the pulleys, etc. Over the whole length of the mast this ladder shall be fitted with semi-circular hoops at right-angles to the mast, to which their ends shall be fixed; the hoops shall be not more than 50 cm. distant from each other and shall constitute guards within which the worker can move up and down the mast.

(d) The crane winch shall be installed in a shelter that is open only on the side nearest the crane. The shelter shall be sufficiently large and well lighted; there shall be no cracks in the walls or roof.

The winch shall be securely fixed to its foundation so as to prevent it from moving towards the crane when loads are being hoisted.

All pinions and toothed wheels shall be suitably encased.

The motors of electric winches shall be earthed.

When the winch is driven by a single engine for all three movements of the crane (raising the jib, raising the hook on the jib and rotating the crane on its vertical axis) the jib shall be lowered by means of the engine and not of the brake.

The lowering of the load by means of the hook, with the jib stationary, may be performed by means of the brake when the load is not more than half the prescribed maximum.

The strength of the brakes shall be calculated for the prescribed maximum load.

The pedals of the brake levers shall be placed at a sufficient distance from each other to eliminate the risk of the driver pressing on the wrong pedal.

(e) The platform of the turntable shall be fitted with guard-rails."

(O. 5.5.1930, sec. 138.)

(c) HOISTS

General

GERMANY

Power-driven Building Hoists

A. General Rules

" 82. The working speed of the cage (*Fördergerät*) shall not exceed 1.5 m. per second; exceptions shall be allowed in respect of the descending speed of kibble hoists (*Muldenaufzüge*) without approaches, and building hoists on which the lifting capacity of the winch does not exceed 600 Kg.

83. The drive and the driver's stand shall be safeguarded at a height of at least 2 m. by a protective roof and shall be so arranged that the person operating the controls can see at least the lower loading place.

The roof shall be waterproof.

84. The brake installation shall comply with the following requirements:

(a) Drive brakes shall be so installed that they can brake the cage without jolting when it is descending with double the working load.

(b) Hand brakes shall act automatically when the brake lever is released and shall be so installed that the braking force in correct operation cannot be increased beyond the prescribed amount.

(c) Pawls shall not be used as safety catches.

(d) On building hoists with a limited descending speed (cf. section 82), when the controls are " off ", the brakes shall automatically be applied.

85. The hoisting rope shall be prevented from mounting the drum sides.

86. For the cage and its counterweight, one suspension shall suffice. If more than one suspension is provided, the load shall be equally distributed among them.

88. Cages that can be entered by persons shall be equipped with safety catches or keps. A cage shall be considered as not capable of being entered by persons when the approach opening in the shaft is not more than 1.3 m. high measured from the floor, or the cage serves only to convey a means of transport specially adapted to it (truck, basket, carrier, etc.) which almost completely covers its floor area, or the shape of the cage excludes its use by persons.

89. It shall not be possible for the load to interfere with the working of the safety catch. Keps shall come into operation before it is possible for a person to enter the cage.

90. The position of the cage shall be directly or indirectly indicated at the driver's stand (e.g., by means of rope marks).

91. Every hoist shall bear a notice at a visible place on the winch and on the cage.

(a) The notice on the winch shall show the maker's name, the year of manufacture, the factory number, the lifting capacity of the winch, the diameter of the appropriate rope, and the lifting speed at a certain number of revolutions of the driving shaft.

(b) The notice on the cage shall show the maker's name, the year of manufacture, the factory number, and the authorised load.

92. On building hoists that can be entered by persons a warning notice with the following text shall be affixed:

"Caution! Hoist. Lifting capacity Kg. Conveyance of persons prohibited."

And on hoists that cannot be entered by persons:

"Caution! Hoist. Lifting capacity Kg. Entering the cage prohibited."

B. *Special provisions for Platform Hoists with Scaffolding Shafts*

97. Control devices shall be installed only outside the shaft, but stopping devices for the various floors shall also be installed inside the shaft or on the platform.

98. Counterweights shall be in one piece, or consist of a number of parts that are securely and immovably fastened together, and shall be so arranged that they cannot leave their guides at the top and bottom.

(T.P. 8.6.1929.)

AUSTRALIA

New South Wales

Hoists for Building Operations: Sheaves or Pulleys

"(2) (a) The minimum diameter at the bottom of the groove of any hoist rope sheave or pulley shall not be less than twenty times the diameter of the rope used on it for speeds not exceeding 120 ft. per minute. For each increase in speed of 60 ft. or part thereof per minute in excess of 120 ft. per minute the diameter of the sheave or pulley shall be increased by an amount equal to twice the diameter of the rope.

(b) Hoist rope sheave spindles shall be fitted with standard plummer block bearings and these bearings shall be fitted with lubricating devices so that they will receive necessary lubrication.

(c) No hoist rope sheave or pulley with a broken flange, rim arm or boss shall be used.

(d) Hoist rope sheave or pulley spindles and bearings shall be discarded and replaced when they become excessively warm.

Hoists for Building Operations: Hoist Winches used in Connection with Building Operations.

(4) (a) The gears, pinions and all revolving or reciprocating parts of hoist winches shall have a minimum factor of safety of six, and this factor of safety shall be obtained by dividing the lowest ultimate strength of the material by the computed stresses from all causes produced under conditions of maximum load.

(f) Every winch frame shall be of rugged construction and positively secured in position by holding down bolts of adequate diameter, which shall be kept drawn up tight when the winch is in use.

(g) All winch control levers, and the controls of the engine or electric motor driving the winch, shall be so grouped that every such control lever and control is within workable reach of the person acting as driver in charge of the hoist from the position which such person takes up when driving the hoist. The maximum throw of the control lever of a friction hoist winch shall not exceed 60 degrees.

(h) Every hoist rope barrel shall be provided with continuous flanges at each end.

(i) An efficient brake shall be fitted on the winch, and such brake shall be capable of exerting a restraining torque 50 per cent. greater than the torque transmitted to the brake drum from the suspended maximum load, exclusive of the friction in the transmission parts between the load and the brake. To stop a hoist with full load at maximum speed in either up or down direction a brake applied by hand shall not require a greater force than 40 lbs. at the end of the hand lever and a brake applied by foot shall similarly not require more than 80 lbs. on the pedal.

Brake blocks and linings shall be protected from the action of water. Brakes shall be provided with a device to compensate for the wear of the linings or wear of the brake block. Brake weights shall be bolted or otherwise securely attached to their levers. Brake linings shall be effectively and permanently secure even after they have become worn.

(j) If the winding member is driven through a friction clutch, such clutch shall be of a type which can be instantly disconnected.

Friction clutches shall be protected from the action of water.

The faces of jaw clutches shall be kept square.

Jaw clutches with chipped or broken jaws shall not be used.

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Platform Hoists used in connection with Building Operations

(6) (a) The parts of a builder's hoist frame structure including the hoist platform and the supports for the overhead rope sheaves shall be so constructed as to have a factor of safety of not less than four under maximum load conditions. This factor of safety shall be determined by dividing the lowest ultimate strength of the material by the computed stress from all causes when the hoist is working."

(R. 17.9.1929.)

Queensland

As for *New South Wales*.

AUSTRIA

(b) Mortar Hoists

"In the case of ordinary mortar hoists (consisting of a wheel on a shaft with two containers suspended by ropes) the shaft shall be placed so high above the workers' stand that they cannot reach it even with outstretched hands; or the shaft shall be covered so that the workers cannot touch it. At the loading and unloading points, toe-boards (nailed laths) shall be set on the boarding of the scaffolding, and at breast height a cross bar or handrail which the workman manipulating the rope can grasp with his free hand."

(O. 7.2.1907, sec. 22.)

BULGARIA

"49. . . . the hoist shall not be provided with places for storing goods."

(O. 4.5.1935.)

DENMARK

Hoists for Building Materials

"1. The hoist and all gear connected therewith shall be of good materials and sound construction throughout.

2. The hoist shall bear a clear and indelible distinctive mark.

5. The platform shall be fitted with a reliable, self-acting safety catch that will bring it to a standstill after a fall of not more than 15 cm. in the event of the rope breaking. The safety catch shall be protected so that its operation cannot be in any way impeded by the goods carried on the lift.

6. The platform shall be fitted with a blocking device by means of which persons using the platform at upper storeys can ensure that the platform will not be moved without their knowledge.

7. The hoist shall be fitted with a device that automatically stops the platform when it reaches its highest point.

9. A conspicuous notice shall be affixed in a durable manner at all loading points, bearing the words: "Goods hoist! Caution! Not to be used for passengers!" The notice shall also indicate the maximum load permitted.

10. The hoist and all gear connected therewith shall be kept in good order. The proprietor or his representative shall be obliged, as soon as any radical defect or irregularity is noted, to put the hoist out of action until it has been properly repaired."

(N. 1.1.1928, Part I.)

Bucket Hoists for Concrete

"3. The container, the suspension rope and all the other parts of the hoist shall always be kept in good order."

(N. 1.1.1928, Part II.)

UNITED STATES

California

Construction Material Elevators

"(f) Whenever a material hoist is used and when it becomes necessary for a workman to cross or pass over the cage, some locking device must be provided to prevent the cage from being moved while the workman is crossing or passing over the cage.

(g) The overhead sheave beams shall be of sufficient size and strength to safely carry twice the maximum weight of cage and contents. They shall be select Oregon pine or equal, and shall be bolted, not nailed, together. In all cases the sheave bearings shall be mounted on top of beams and securely bolted to them and abut against the sheave hub.

(h) The guide posts shall be made of select Oregon pine or equal, and shall be securely fastened and braced.

(i) The guide rails shall be made of select Oregon pine or equal, and they shall be securely bolted to the guide posts.

(l) The minimum requirements for all material elevator sheaves shall be not less than given in the following table:

Diameter of hoisting cable (inches)		Diameter of sheave (inches)	Diameter of axle (inches)
$\frac{1}{2}$	.....	12	$1 \frac{3}{16}$
$\frac{5}{8}$	.....	14	$1 \frac{7}{16}$
$\frac{3}{4}$	.....	16	$1 \frac{11}{16}$
$\frac{7}{8}$	.....	18	$1 \frac{15}{16}$
1	.....	20	$2 \frac{3}{16}$

Note. — Diameter of sheaves shall be measured at bottom of groove.

(m) All sheaves shall be of iron or steel and of sufficient strength to support the loads which they have to carry.

(n) The grooves of all sheaves shall be smooth and concentric with the axis.

(o) All sheaves shall have fixed axles of a grade at least equal to mild steel.

(p) All sheave bearings shall be lined with babbitt or other equivalent bearing metal and shall be provided with ample means for lubrication.

(w) Every hoisting engine shall be equipped with proper brakes to sustain its maximum load in any position.

(x) Electric hoists shall have all friction levers, controller handles and foot brakes properly grounded when working parts of the derrick may form a circuit with a live wire.

(G.O. 1.7.1926. Order 1114.)

Construction Material and Man Elevators

“ Order 1115

“(c) The cable drum of the hoisting machine shall be rigidly and permanently attached to the driving mechanism. Friction gearing or clutch mechanism shall not be used.

(d) All hoisting machines shall be provided with an automatic brake of sufficient holding power to prevent rotation of drum in either direction when the power is cut off from the machine.

(e) All hoisting machines shall be provided with an efficient device which will automatically bring the cage to a stop at the top and bottom limits of travel.

(f) The minimum diameter of all drums and sheaves shall be forty (40) times the diameter of the cable used on them, and speed of cable shall not exceed 200 ft. per minute.

Note. — Wherever the diameter of sheaves and drums is mentioned it has reference to the minimum diameter to be used. However, it is recommended that larger sheaves and drums be used.”

(G.O. 1.7.1926.)

Pennsylvania

“(f) Adequate and effective brakes shall be provided on all hoisting machines capable of holding the car and its maximum load immovable at any point of travel. The hoisting machine shall also be provided with a pawl and gear.

(h) A new installation of a freight elevator (in a new building) where the hatchways, enclosures and gates have not been completed may be used as a builder's hoist, provided the car is enclosed, the hatchway protected and the entrances guarded as required for builders' hoists erected on the inside of buildings. Such an elevator shall be in charge of an experienced operator, and may be used for carrying freight of building materials. Only the operator

and the assistants necessary for handling the load, who may not exceed three, are permitted to ride. A freight elevator used as a builder's hoist shall be properly tested and approved by an authorized inspector and a certificate issued as a builder's hoist before being put in service as a hoist.

(i) A new installation of a passenger elevator (in a new building) where the hatchways, enclosures and gates have not been completed, may be used as a builder's hoist, provided the car is enclosed on three (3) sides, and the hatchway protected as required for builders' hoists erected inside of buildings. No bars will be required at the entrance to the elevator but hinged and slatted gates, six (6) feet high shall be used and the gates shall be locked from the inside of the hatch.

A passenger elevator used as a builder's hoist may be properly tested and approved by an authorized inspector and a certificate issued as a builder's hoist before being put in service as a hoist.

Such an elevator shall be in charge of an experienced operator, and may be used for carrying passengers as well as building materials. Three (3) square feet of floor space shall be allowed for each passenger.

The number of persons permitted to ride at any one time shall be based on the ratio of one person to three square feet of floor area."

(R. 1933, Rule 22.)

(For the structural requirements to be satisfied by hoists when persons are allowed to ride: see under "Transport of Persons".)

Wisconsin

"Order 3528. *Elevators*. 1. Every elevator, whether a temporary installation or any part of which is to be used as permanent equipment in any building, shall conform to the requirements of the Elevator Code issued by the Industrial Commission, except that the permanent hoistway enclosure, car platform, car enclosure, car doors, landing doors, machinery floor and penthouse construction need not be installed if temporary equivalent construction and protection are provided."

"Order 3529. *Hoists*. The diameter of sheaves and drums for hoists shall be not less than the following:

Diameter of wire rope (inches)	Diameter of sheave or drum tread (inches)
$\frac{3}{8}$	12
$\frac{1}{2}$	12
$\frac{5}{8}$	14
$\frac{3}{4}$	16
$\frac{7}{8}$	18
1	20

The sheaves and drums for all hoists shall be of steel or cast iron, except that lining (or lagging) may be of hard wood.

The engine or motor for every hoist shall be equipped with brakes which will sustain the load in any position. Every hoisting machine shall be so arranged or equipped that the position of the car or platform at the bottom, top and other desired or necessary stopping positions are accurately indicated to the operator."

(G.O. 15.7.1933.)

FINLAND

Hoists

" 31

The motive power of the lift shall be such that it can be shut off quickly, and the machinery shall be arranged so that it comes to a standstill directly the power is shut off.

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In the erection in direct connection with scaffolding of so-called "hoists for long goods", to lift iron rods for reinforced concrete or timber, care shall be taken that within a radius of not less than 5 m. round the hoist the scaffolding is provided from top to bottom with safety fencing consisting of planks beyond which the ends of putlogs and other parts of the scaffolding shall not be allowed to project. If a jib is used for the transportation of long goods, it shall be made of iron or sufficiently strong timber reinforced with iron. If the jib is attached to a scaffold standard, the standard shall be proportionately reinforced and anchored to a firm part of the building.

When bricks, cement and concrete are being conveyed by means of a hoist suspended from a putlog, the provisions laid down above in respect of jibs and their attachment to standards and the reinforcement of such standards shall be observed in respect of the reinforcement of the standard. The unloading stage on the scaffolding and the putlogs and ledgers supporting it shall be adequately reinforced. The scaffolding shall be braced at the loading place with diagonal and cross braces parallel to the length and breadth of the building."

(Res. 15.11.1927)

LUXEMBURG

"23. . . . The load and guide pulleys of a lift shall be fixed on a frame erected for the purpose and sufficiently strong and stable."

(O. 28.8.1924.)

MEXICO

"512. The pulleys over which the ropes of goods hoists or passenger lifts pass shall have efficient guards to prevent the rope from slipping off the pulley.

513. When a hoist is worked by means of a rope, cable or chain, the said rope, cable or chain shall be protected so as to ensure that the hoist cannot be set in motion from any other point.

515. All hoists, except those driven by hydraulic power, shall be fitted with a safety catch that grips the guide rails and holds the cage in the event of the ropes slipping or breaking. This catch shall be actuated by a spring or by some mechanical means, and in no case by gravity.

520. Platforms with guard-rails, and permanently fixed ladders giving access to these platforms shall be provided for the use of workers repairing or greasing cranes or hoists."

(R. 28.11.1934.)

CZECHOSLOVAKIA

(b) *Mortar Hoists*

"52. (1) In the case of ordinary mortar hoists (a windlass with one or two buckets suspended from ropes) the shaft shall be placed so high above the workers' standing place that they cannot reach it even with up-stretched hands, or the shaft shall be enclosed in such a manner that the workers cannot touch it. Battens (treads) shall be nailed to the planking of the scaffold in front of the hoist opening. A safety bar or guard-rail, breast high, which the person handling the rope can hold with his free hand, shall be provided.

(2) The windlass shall be fitted with one or two pawls (according to the number of buckets) and a band brake or other efficient braking device. Windlasses (a shaft with a hand crank) not fitted with a pawl shall not be used."

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

"72. Power-driven hoists shall be fitted with an automatic device for cutting off the power at the ends of the cage's travel.

A second automatic device limiting the travel and independent of the first shall not be required.

In the case of friction driven winches (with a freely moving cage) it shall not be necessary to provide a stopping device at the lower limit of travel.”
(O. 27.3.1931.)

YUGOSLAVIA

“ 126. In the case of the usual hoists for mortar (in the form of a bucket attached to a rope running round a pulley) the pulley shall be placed at a sufficient height, not less than 2 m. above the platform of the scaffold, to ensure that there is no danger to workers in the vicinity.”

(R. 25.10.1921.)

Cages and Hoisting Platforms

GERMANY

Power-driven Building Hoists

“ 87. Cages shall be so fenced that the load cannot fall out. If trucks are run on the platform of the cage, a non-removable catch shall be provided for them.”

(T.P. 8.6.1929.)

AUSTRALIA

New South Wales

Lift Boxes

“ 12. Lift boxes to carry up to 3 tons to be made of 2 in. Oregon properly framed together, each box to have two carrying straps made of 3 in. \times $\frac{5}{8}$ in. iron passing under the bottom of the box and up each side, and secured to the timber with $\frac{5}{8}$ in. bolts. Eyelet holes to be formed on top to receive box chains; boxes for lighter loads may be of proportionately lighter construction.”

(A. 26.11.1912, Schedule, sec. 12.)

Platform Hoists used in connection with Building Operations

“ (b) The platform shall be arranged to operate between suitable vertical guides and such guides shall be secured to the building floors, building framework, or other structure surrounding them, by bolts not less than $\frac{5}{8}$ of an inch in diameter.

(c) The hoist platform shall be so constructed that it will not show any signs of distortion when the maximum load to be lifted or lowered is placed in any position upon it.”

(R. 17.9.1929, sec. 6.)

Queensland

As for *New South Wales*.

BULGARIA

“ 49. The cage shall be well built and safe to use; it shall only be used for conveying materials”

(O. 4.5.1935.)

UNITED STATES

California

Construction Material Elevators

“ (b) ¹ The cage sling frame shall be made of selected timber or structural steel of sufficient strength safely to resist the maximum effort of the hoisting machine.

¹ Applies also to “Construction Material and Man Elevators”.

(c) ¹. The cage platform shall be a solid floor built of wood at least two (2) inches thick and shall be securely braced to the frame.

(d) Cages shall have unused sides enclosed to a height of 42. in with boards or No. 16 U.S. standard gauge wire screen to protect workmen from falling material.

(e) The cage shall have a covering of not less than No. 16 U.S. standard gauge wire screen, or wooden slats not less than three-fourths ($\frac{3}{4}$) of an inch in thickness, and no opening in such covering shall exceed three-fourths ($\frac{3}{4}$) of an inch in at least one direction. Such covering shall be hinged near the cross beam and left free to swing upward if caught while cage is descending."

(G.O. 1.7.1926, Order 1114.)

Construction Material and Man Elevators ²

"(g) Cages shall have three sides enclosed to a height of six (6) feet with boards or No. 16 U.S. standard gauge wire screen in a secure and substantial manner."

(G.O. 1.7.1926, Order 1115.)

Ohio

"Section 116. Covering shall be provided for the cage of not less than No. 16 U.S. standard gauge wire screen or wooden slats not less than three-fourths ($\frac{3}{4}$) inch in thickness with no opening in the covering greater than three-fourths ($\frac{3}{4}$) inch in at least one direction. Such covering shall be hinged at the cross beam and left free to swing upward if caught while the cage is descending."

(S.R. March 1931.)

Pennsylvania

"Rule 22. Hoists. (a) The . . . cars of hoists shall be constructed of material of ascertained soundness and capability to sustain safely the maximum load to be imposed on them.

(d) The platform of a car shall be a solid flooring built of wood at least two (2) inches in thickness and shall be securely braced to the stiles. All sides of the car not used for loading or unloading shall be substantially enclosed to a height of at least six (6) feet or to the upper car beam if less than that height.

(e) The cars of all hoists shall be provided at the top with a cover of either solid material or grille work. If wire mesh is used, it shall not be less than No. 10 wire, with a mesh of such size as to reject a ball one and one-half ($1\frac{1}{2}$) inches in diameter. The covers shall be set back not more than six (6) inches from the landing threshold and shall be hinged on the landing side not less than eighteen (18) inches back so as to fall back should the edge of the cover be obstructed in its descent."

(R. 1933.)

Wisconsin

"2. Construction of Car. The car, including the platform, frame and sling of every hoist platform cage or other container shall be designed and constructed to conform with the requirements of Order 3512³ as applied to scaffolds."

(G.O. 15.7.1933, Order 3529.)

GREAT BRITAIN

"20. Every box used for hoisting bricks or other loose material shall be closed in, except on one side. One or more of the sides may be hinged or securely slotted."

(R. 30.9.1931.)

¹ Applies also to "Construction Material and Man Elevators".

² See also under "Construction Material Elevators" above.

³ See under Chap. I, § 1 (c) "Scaffold Materials and Construction".

IRISH FREE STATE

As for *Great Britain*.

ITALY

“ 10. The moving cage of goods and passenger lifts and elevators shall move within guides and be of a shape which makes it safe for the use for which it is intended”

(M.C. 9.9.1925.)

UNION OF SOVIET SOCIALIST REPUBLICS

“ 68. The hoist cage may be made of wood with an iron framework and need not be fitted with gates.

The transverse sides of the cage shall extend to its full height.

If loading and unloading is effected at one side of the cage only, the opposite side shall be enclosed in addition to the two transverse sides.

If the cage is used for hoisting loose materials without packing, it shall be fitted on two sides (not the two transverse sides) with a barrier of sufficient height. If it is used for hoisting barrows, the cage shall be fitted with supports which prevent the barrows from moving.

69. When two cages are used simultaneously for hoisting and lowering materials, the hoist shaft shall be divided from one end to the other by a partition of boards or mesh which will separate the two cages.

The cages shall be suspended in such a way that when both cages reach their lowest working point the cables remain taut.

70. The cage may be suspended by a single cable, the breaking strain of which shall in no case be less than four times the maximum load. (The formula to be used for calculation is given in section 39.¹)

71. The cage may be lowered to the bottom of the shaft.”

(O. 27.3.1931.)

URUGUAY

“ X. The movable part of hoists, lifts and elevators shall be so constructed as to be safe for the use for which it is intended. . . .”

(D. 14.4.1915, sec. X.)

§ 2. — Supporting Structures

(a) CRANE TOWERS, GANTRIES, STAGES, AND TRACKS

GERMANY

Jib Cranes

“ 106. At the ends of limited runways and lengths of track there shall be strongly built stops about the height of the wheel hub, or buffers.

108. In the construction of the track for jib cranes allowance shall be made for increased wheel pressure, especially when the jib is swung out towards the side. The superstructure shall possess sufficient bearing capacity. Where the nature of the operations requires the jib to be swung out of the direction of travel on curves, the outer rail shall not be raised.

109. (1) The rails shall be so fastened that they cannot be torn up by the safety devices provided against overturning of the crane.

¹ Not reproduced.

(2) The superstructure shall be maintained in proper condition; in particular, care shall be taken that the rails are horizontal. Unevenness, subsidence and dangerous bumps in the rails shall be corrected."

(R. 1.4.1934, Appendix, 2 (h).)

AUSTRALIA

New South Wales

Tower Gantries

" 11. All tower gantries of a height not exceeding 50 ft., for a steam crane with a lifting capacity of less than 5 tons, shall be constructed to the approval of the Inspector.

Tower gantry not exceeding 100 ft. high for a steam crane to lift a weight of 5 tons, and not exceeding 10 tons, to be constructed as follows: Tripod gantry towers to be not less than 6 ft. \times 6 ft., and to be constructed with 7 in. \times 7 in. corner posts, extending the full height of the gantry, properly fishplated and bolted at junctions; corner posts to be firmly tied together by 9 in. \times 3 in. horizontal ties at 10 ft. centres, and each side of the tower to be properly braced with 7 in. \times 3 in. diagonal braces, firmly bolted to the corner posts; each tower to have a centre post 10 in. \times 10 in.; these posts to extend the full height, and to be firmly fishplated at junctions, and to be stiffened at intervals with 5 in. \times 3 in. stays to the corner posts of each tower.

The towers to be constructed by means of horizontal braces 9 in. \times 3 in., spaced not less than 20 ft. apart. Each side of gantry to be braced with diagonal braces of 9 in. \times 3 in., firmly bolted to the timbers of the towers, and at intersections; the towers to rest on 9 in. \times 9 in. sleeper plates, and to be tied together at top by 9 in. by 9 in. kerb; all bolts for gantries to be not less than $\frac{3}{4}$ in. diameter. The back stays of the crane to be tied to the 10 in. \times 10 in. centre post by means of two 4 in. \times 1 in. wrought-iron straps extending over the back stay of the crane and down each side of the centre post. The length of the strap to be 9 ft., and to be firmly bolted to the centre post and to the timbers of the crane by 1 in. bolts. The ends of the straps to be also turned and mortised into centre post $1\frac{1}{2}$ inch. Each centre under the back stays of the crane shall have a platform at the bottom formed of 9 in. \times 3 in. timber firmly bolted to the centre post and to the sides of the tower, and each tower shall be loaded with a weight equal to three times the weight the crane has to lift.

Ladders extending to at least 5 ft. higher than the gantry top platform must be provided on the inside of at least one tower, the platform to be sufficiently close boarded.

The construction of a tripod gantry not exceeding 100 ft. high for a crane to lift from 10 tons to 15 tons to be similar in all respects to the foregoing, with the exception that the corner posts of the tower shall be 8 in. \times 8 in.

Where circumstances necessitate a gantry exceeding 100 ft. in height, it shall be constructed to the approval of the Government Architect."

(A. 26.11.1912, Schedule, sec. 11.)

Queensland

Tower Gantries

As for *New South Wales*.

Crane or Hoist Structure

" (10) Each member of the crane or hoist structure shall be designed to resist all the stresses or combination of stresses which may be induced therein under the conditions hereinbefore described.

The computed stresses for which allowance is to be made shall be the sum of the maximum primary and secondary stresses.

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Rivets and Bolts in Crane or Hoist Structure

(17) The working stress in shear for steel rivets and bolts for use in the crane or hoist structure shall not exceed $4\frac{1}{2}$ tons per square inch. The working stress in bearing for steel rivets and bolts shall not exceed 10 tons per square inch."

(R. 24.12.1930.)

CANADA

Alberta

"(78) A footwalk with handrail and toe-board shall be placed along the entire length of the bridge on the motor side. This walk shall be at least five (5) feet, preferably six (6) feet six (6) inches below the bottom of the overhead trusses, and shall be not less than eighteen (18) inches in width, except where it passes the bridge-motor, where it may be reduced to fifteen (15) inches. Footwalks shall be of substantial construction and rigidly braced.

(79) Truck-fenders shall be provided, and shall extend below the top of rail and project in front of all bridge and trolley truck-wheels and shall be attached to the trolley or the bridge and frame. They shall be of a shape and form that will tend to push and raise a man's hand, arm or leg off the rail and away from the wheel."

(R. 1928.)

GREAT BRITAIN

"1. The stage for every crane shall be built of sound material and shall be of good mechanical construction having regard to its height and position, and to the lifting and reaching capacity of the crane. The platform shall be of sufficient area for the driver or operators and signalman, and, in the case of each guy derrick crane, for the operator of the slewing mechanism. The platform shall be close-planked or plated, securely fenced and provided with safe means of access.

Every fixed crane shall be securely anchored or adequately weighted to ensure stability.

2. On every stage, gantry or other place on which a crane moves, an unobstructed passageway of at least 2 ft. in width shall be maintained at every position of the crane between the cab or any other part of the crane and the edge of such gantry or place, and between the cab or any other part of the crane and any ironwork, steelwork or other material placed near the crane or crane track.

Provided that if at any time it is impracticable to maintain such a passageway at any place or point, all reasonable steps shall be taken to prevent the access of any person to such place or point at such time.

3. All rails on which a travelling crane moves shall (a) be of adequate section and have an even running surface, (b) be jointed by fishplates or double chairs, (c) be securely fastened to sleepers.

The whole track, whether resting on the ground or raised above it, shall be properly laid and any supports shall be of sufficient strength and maintained in good condition.

Provided that requirements (b) and (c) of this Regulation shall not apply to an overhead crane on bridge rails."

(R. 30.9.1931.)

IRISH FREE STATE

"32. The stage for every crane shall be built of sound material, shall be of good mechanical construction having regard to its height and the lifting and reaching capacity of the crane. The crane shall be securely anchored or weighted. The platforms for the driver and signalman shall be of sufficient area, close-planked, securely fenced, and provided with safe means of access.

33. On every stage, gantry or other place on which a crane moves an unobstructed passageway of at least 2 ft. in width shall be maintained at every position of the crane between the cab or any other part of the crane and the edge of such stage, gantry or place, and between the cab or any other part of the crane and any steelwork or other material placed near the crane rails.

44. All rails on which a travelling crane moves shall be of uniform section, shall be secured by fishplates, and shall be securely fastened to sleepers.

Provided that this Regulation shall not apply to an overhead crane on bridge rails."

(R. 5.3.1930.)

SWITZERLAND

Geneva

" 123. If lifting appliances move on a runway, the track and the structure on which it is laid shall be strongly built, rest on solid foundations and lie in a strictly horizontal plane in all directions. Failing ballast, the sleepers between the rails shall be fixed to longitudinal beams along the whole length of the runway. If the soil is soft it shall be covered with ballast 20 cm. deep. The runway shall be 3 or 4 m. longer than the course of the appliance. At each end of the track there shall be buffers or else sleepers placed on the rail, and behind these a sand bank 30 to 50 cm. high and 1.50 m. to 2.50 m. in length."

(R. 25.3.1930.)

UNION OF SOVIET SOCIALIST REPUBLICS

Additional Rules for Travelling Wharf Cranes

" (e) When a crane is working or standing on a railway track with a gradient, even if the gradient is very slight, shoes shall be placed under the wheels of the crane and the brake shall be kept on.

(f) No crane shall be run on a track that is in bad condition. New tracks shall be examined before a crane is taken over them, so as to make certain that they are suitable for the purpose.

(j) When removable struts or supports attached to the rails are used, the attachments should not be screwed up tightly, for their purpose is to provide additional support for the crane after its upper platform has settled into position on the bearings of the carriage."

(O. 5.5.1930, sec. 137.),

(b) HOIST TOWERS AND FRAMEWORK

GERMANY

Special Provisions for Platform Building Hoists with Scaffolding Shafts

" 93. In the case of scaffolding shafts an indication of the strain on the principal supporting parts (calculation of strength) may be required by the competent expert. Independently erected scaffolding shafts shall be secured by means of wire ropes or other safeguards.

Parts of the hoist that lie in frequented areas shall be so fenced that persons cannot be injured."

(T.P. 8.6.1929.)

AUSTRALIA

New South Wales

HOISTS FOR BUILDING OPERATIONS

Timber Towers

“ 11 A. (1) The timber used in the construction of hoist towers shall be of the best grade, well seasoned and free from knots, shakes and other defects

A hoist tower the overall outside dimensions of which do not exceed 5 ft. \times 5 ft. shall be constructed as follows:

(a) The corner posts shall not be less than 4 in. \times 4 in. cross sectional dimensions if in one piece of timber, but if each such corner post is built up of two pieces of timber each piece shall not be less than 5 in. \times 2 in. cross sectional dimensions.

(b) The aforesaid corner posts shall be properly framed together at each side of the tower by horizontal and diagonal braces. The distance between the centres of the horizontal braces shall not exceed 5 ft. The cross sectional dimensions of the said horizontal and diagonal braces shall be not less than 5 in. \times 2 in.

(c) All braces shall be connected to the corner posts by bolts not less than $\frac{1}{2}$ in. in diameter. Square washers having the length of each side not less than three diameters of the bolt and the thickness not less than $\frac{1}{4}$ of the bolt diameter shall be used under the head and nut of each bolt.

(d) If timber is used for the supporting beams of the tower head rope sheaves, such timber shall be hardwood and each beam shall be not less than 6 in. \times 4 in., cross sectional dimensions, provided the length of the said beams is not greater than 6 ft., but if the said length is greater than 6 ft. the cross sectional dimension of the longer beams shall be such as to provide the same margin of safety as would obtain if the shorter beams were used.

(e) A platform constructed of planks not less than $1\frac{1}{2}$ in. in thickness shall be provided and fixed adjacent to the tower head rope sheaves to give a safe means of access to such sheaves for maintenance purposes. Such platform shall be protected on all sides by guard-rails which, if of timber, shall be not less than 3 in. \times 2 in., cross sectional dimensions, fixed at a height of 3 ft. above the surface of the platform to timber posts of cross sectional dimensions not less than 3 in. \times 3 in. Ropes shall not be used for such guard rails.

(f) A ladder, constructed in conformity with these Regulations, shall be fixed to the tower to provide a safe means of access to the platform, referred to in paragraph (e) of this Regulation, from a floor of the building or from the ground, as the case may require. Landing platforms shall be fixed at every 30 ft. in the height of such ladder.

(g) The hoist tower shall be effectively enclosed and shall be kept so enclosed, by close-fitting timber boarding not less than $\frac{3}{4}$ in. in thickness, or by 18 gauge wire netting having a mesh not greater than 2 in., or by black or galvanised steel sheeting of thickness not less than 24 gauge, positively fixed to the outside of the tower frame to a height of not less than 6 ft. above the level of every floor, scaffolding, platform or stairway adjacent to the hoist tower.

(h) If the hoist tower is set up within or contiguous to a building it shall be positively fixed to the building at each floor level. If it is set up in any other position it shall be kept upright by steel wire guy ropes, the breaking load of which shall not be less than four times the maximum load to which they are subjected. The guy ropes shall be effectively secured to the tower corner posts and efficient provision made for keeping every guy taut. One set comprising four guy ropes shall be used for every 30 ft. of tower height. The anchorage for the guy ropes shall be so spaced that the guys will be not more than 90 degrees apart in plan.”

(R. 17.9.1929.)

Queensland

As for *New South Wales*.

BULGARIA

"48. The base of the hoist shaft shall be square and at least 2.50×2.50 m. The bottom of the shaft shall be boarded in up to a height of 2 m. . . ."

(O.4.5.1935.)

CHILE

"393. The framework of goods hoists shall consist of beams of at least 0.15×0.15 m. in cross section, arranged in a triangle and adequately braced. Clamps and collars shall be used to join the various parts.

The raising and lowering of workers or materials shall be effected by means of fixed pulleys securely fixed to the stoutest parts of the construction. Any machinery installed for operations within the framework of hoists shall be placed outside the framework.

394. A special permit shall be required from the Department of Municipal Works for the installation of any hoist framework on the pavements of public thoroughfares. Such permits shall be issued for a definite period and may be withdrawn as soon as they give rise to any inconvenience.

395. In the case of buildings exceeding 12 m. in height, or special buildings, the Department of Municipal Works may call for plans and calculations in respect of the scaffolding and structural parts of hoists. In no case shall the load on such scaffolding exceed one-fifth of the breaking load."

(D. 14.1.1930.)

DENMARK

Bucket Hoists for Concrete

"1. The bearing parts at the top of the shaft shall be sufficiently strong and secure to hold the container in the event of over-winding."

(N. 1.1.1928, Part II.)

UNITED STATES

California

"Order 1113. *Construction Towers.* (a) All towers used on construction work shall rest upon solid foundations and all wooden members shall be securely nailed or bolted.

(b) All materials, except the cage or bucket guides, shall be select common Oregon pine or equal. The cage or bucket guide shall be clear, straight grained Oregon pine or equal, free from knots and other defects.

(c) The sizes of the various members in towers shall consist of lumber as specified in the following table:

Capacity of bucket or live load of builders' cages	Corner posts			Guide post thick- ness	Horizontal cross ties		Spacing of cross ties (feet)
	Up to 75 ft. high	Up to 125 ft. high	Over 125 ft. high		Up to 50 ft. high	Over 50 ft. high	
500 lb. cage.	4 × 4	4 × 4	4 × 4	3	1 × 6	—	6
¼ cu.yd. or 1,000 lb. cage	4 × 4	6 × 6	6 × 6	3	1 × 6	—	6
½ cu. yd. or 2,000 lb. cage	6 × 6	6 × 6	8 × 8	4	2 × 6	2 × 6	8
1 cu. yd. or 4,000 lb. cage	6 × 6	8 × 8	8 × 8	4	2 × 6	2 × 6	8

(d) Not more than two (2) ties shall be removed from any panel point in the tower at any one time and never from two consecutive panels.

(e) The diagonal cross bracing shall be at least one by six (1 × 6) inches for all towers and shall occur on each of the four (4) sides of the tower and between each tier of horizontal cross ties except at loading and unloading platforms, in which case some other bracing of equivalent strength shall be provided.

(f) The splices of corner posts shall be made with square butt joints and with at least two (2) pads or scabs on the adjacent sides. The pads or scabs shall be the same width as the corner posts and not less than two (2) inches in thickness, and must extend at least two (2) feet on each side of the joint.

(g) All towers shall be securely tied to the building or anchored with cables so as to prevent them from swaying or tipping.

(h) Whenever towers are independent of the building, they shall be anchored at each corner post every thirty-two (32) feet in height by at least a three-eighths ($\frac{3}{8}$) inch cable.

(i) Where spouting equipment, of whatever kind, is supported by the tower, the tower shall be built in such manner as to carry safely any and all stresses caused by such loads.

(j) Whenever a boom is supported by the tower, the boom anchor shall be located at a level where guy lines are attached, and the upper fastening of the falls which raise and lower the boom shall be placed at a distance not less than one-half ($\frac{1}{2}$) the length of the boom above the boom anchor, and at a level supported by the guys. The guys supporting these two points shall be designed to carry the extra load caused by the boom.

(k) The hopper brackets on all towers shall be designed and constructed with a safety factor of at least six (6).

(l) Whenever employees are required to work on the platform of the hopper bracket, a two-rail railing three and one-half ($3\frac{1}{2}$) feet high shall be provided around the platform."

(G.O. 1.7.1926.)

Ohio

"Section 112. Where spouting equipment for handling material is supported by a tower, such tower shall be so designed, constructed and maintained as to carry safely any and all stresses caused by the maximum working loads to be imposed thereon.

Section 113. Whenever a boom is supported by a tower, the upper fastenings of the falls for raising and lowering the boom shall be placed at a distance not less than one-half ($\frac{1}{2}$) the length of the boom above the boom anchor, and at a level where guy lines are attached. The supports at these two points shall be designed to carry the extra load caused by the boom.

Section 114. Concrete chutes or spouts shall be supported to withstand wind pressure calculated on a basis of 20 lbs. per square foot, and all parts exposed to wear or deterioration shall be inspected at least once each week and after each moving or changing of chutes. Chutes shall be of sufficient strength to support the weight of a man in addition to the weight of the concrete.

Wooden Towers

Section 117. Wooden towers shall be constructed of material of a grade not less than that specified in section 23¹ of this code, strongly cross-braced and strutted and placed upon firm and substantial foundations.

¹ Specifications not reproduced.

Section 118. The sizes of the various members in wooden towers shall be not less than the following:

Capacity of bucket or live load of builder's cage	Corner posts			Guide posts thickness	Horizontal cross ties		Maximum spacing of cross ties
	Up to 75 ft. high	Up to 125 ft. high	Over 125 ft. high		Up to 50 ft. high	Over 50 ft. high	
	inches	inches	inches	inches	inches	inches	feet
500 lbs. cage	4×4	4×4	4×4	3	1×6	2×6	7
¼ cu. yd. or 1,000 lb. cage	4×4	4×6	6×6	3	1×6	2×6	7
½ cu. yd. or 2,000 lb. cage	4×6	4×6	6×8	4	2×6	2×6	8
1 cu. yd. or 4,000 lb. cage	6×6	6×6	8×8	4	2×6	2×6	8

Section 119. Not less than one diagonal brace shall be provided in each panel between horizontal cross-ties for towers up to fifty (50) in height. For towers more than fifty (50) in height, two (2) diagonal braces shall be used.

Section 120. On wooden towers constructed on the outside of buildings or structures not more than two (2) braces shall be removed from any panel between horizontal cross-ties in the tower at any one time and never from two consecutive vertical panels.

Section 121. On wooden towers constructed inside of elevator shafts, hatchways, stairwells, outside courts and light shafts, diagonal bracing of two (2) opposite sides may be removed at the same time, but other bracing or reinforcement the equivalent in strength of that removed shall be provided.

Section 122. Diagonal cross bracing for all towers shall occur on each of the four sides and between each tier of horizontal cross-ties except at landing and unloading platforms, in which case some other bracing or reinforcement of equivalent strength shall be provided.

Section 123. Splices of corner posts shall be made with square butt joints, with two battens or scabs at each joint on adjacent sides, two (2) inches thick, the width of the post and extend at least two (2) feet on each side of the joint, or halved with an even fit and securely bolted.

Section 124. All wooden towers shall be securely guyed or braced against excessive swaying or tipping. When towers are independent of the building, they shall be anchored at each corner post every thirty-two (32) feet in height by not less than five-eighths (5/8) inch steel cable or its equivalent in strength. The interval of spacing anchors may be increased and the number of guys reduced to permit the use of apparatus having long booms when the materials used and the method of construction employed provides a factor of safety not less than the requirements of this code.

Section 125. The hopper brackets on all wooden towers shall be designed and constructed with a safety factor of not less than six (6).

Section 126. The cage or platform sling frame shall be made of selected timber or structural steel of sufficient strength safely to support the maximum working load to which it may be subjected.

Section 127. The cage platform shall be a solid floor of wood not less than two (2) inches thick or other material of equal strength and shall be securely fastened to the frame.

Section 128. The overhead sheave beams shall be of sufficient size and strength to carry safely the maximum working load and increased stresses of stopping and starting. The sheave beams shall be bolted or lag screwed

together, not nailed, and the sheave bearings shall be mounted in all cases, on top of the beams, securely bolted to them and abut against the sheave hub.

Section 129. The guideposts and the guide-rails shall be of the material and grade as specified in Section 23¹ of this code. Guideposts shall be securely fastened and braced. The guide-rails shall be securely bolted to the guideposts and shall be carefully alined and kept in good condition.

Steel Towers

Section 130. All steel construction towers, masts, hoists, etc., shall be built to conform to the 1928 specifications for steel construction adopted by the American Institute of Steel Construction, except that single bolted connections may be used, provided they are properly designed to carry the maximum working loads and stresses to be imposed upon them.

Section 131. All steel construction towers, masts, hoists, etc., shall be placed upon firm and substantial foundations and securely guyed against swaying or tipping. Particular care shall be given to securely anchoring and guying the top of the towers or masts and also at the bucket dumping position where such equipment is used. Towers, masts or hoists on which booms are to be supported and used shall be so designed or strengthened at the points where the boom may be attached as to sustain safely the maximum working load and the action of such equipment.

Section 132. Where steel construction towers, masts, hoists, etc., are secured or anchored to the building or structure, they shall be substantially secured at intervals of not more than forty (40) feet. Where such towers or masts are erected independent of the building or structure the towers or masts shall have substantial guy anchorage at each corner post or to cross-arm brackets, at intervals not exceeding forty (40) feet. The interval of spacing anchors may be increased and the number of guys reduced to permit the use of apparatus having long booms, when the material used and the method of construction employed provides a factor of safety not less than the requirements of this code.

Section 133. All guy lines used in anchoring and securing steel towers and mast hoists shall be not less than five-eighths ($\frac{5}{8}$) inch steel cable or its equivalent in strength.

Section 134. When it is necessary to remove diagonal bracing at the bottom or other levels of steel towers for loading or unloading, or for any other purpose, some other bracing or reinforcement of equivalent strength shall be provided."

(S.R. March 1931.)

Wisconsin

"Order 3529. Hoists. 1. Hoist Framework and Guides. The tower or other framework for the support of the car and other hoist equipment shall be designed and constructed to carry safely all applied loading in accordance with the provisions of Order 3513,² and details of construction shall comply in all respects with the requirements which apply to scaffolds. Posts and connections, if of wood, shall conform to the following requirements:

Car capacity	Nominal size of corner posts		Normal size of horizontal ties		Nominal size of bracing
	Height (in feet)		Size	Vertical spacing	
	Less than 100	100 or more			
Not more than 500.	4×4	4×4	2×6	6	2×4
500 to 1,000	4×4	4×6	2×6	6	2×4
1,000 to 2,000	4×4	6×6	2×8	8	2×6
2,000 to 4,000	4×6	8×8	2×8	8	2×6

¹ Specifications not reproduced.

² See under Chap. I, § 1 (c) "Scaffold Materials and Construction".

Where the height of a hoist tower does not exceed 60 ft., and the car capacity does not exceed 2,000 pounds, the corner posts may be not less than nominal 4×4 in., the ties not less than nominal 2×6 in., and the braces not less than nominal 1×8 in.

Where the hoist tower or hoistway is made of material other than wood, the structure shall be the equivalent of the required wood construction in strength and rigidity.

The beams supporting drums, sheaves or other load transmitting equipment shall be designed as required under Order 3512,¹ and shall be fastened in place."

(G.O. 15.7.1933.)

ITALY

"10. Appliances used for lifting materials shall not rest on or against the roofing or supports of gangways. Nevertheless, the said supports may also be used for the framework of lifting appliances when they are deemed strong enough to sustain the maximum strain which they will have to bear."

(R.D. 27.5.1900.)

MEXICO

"514. The sides of hoists that are not used as means of access for goods or passengers shall be fenced to a height of not less than 1.80 m. from the floor of the hoist with strong wire netting of small mesh. Unless specified to the contrary, the hoist shall be roofed in with strong material to prevent injury to the passengers or goods it contains through the falling of any tools or materials from above."

(R. 28.11.1934.)

CZECHOSLOVAKIA

"47. (1) Goods lifts shall always be erected in a special sufficiently strong frame, carefully constructed to prevent the transmission of the shaking and vibration set up by the mechanical apparatus to the remainder of the scaffolding, and to prevent the imperilling of the persons employed in the vicinity by falling materials. An automatic device shall be fitted to the top of the cage to prevent overwinding. A protective roof of adequate size and sufficiently strong materials shall be erected over the loading platform of bucket elevators.

(2) The wells of goods lifts (bucket elevators, platform lifts, bracket hoists fixed to standards (poles), hoisting apparatus (winches) with buckets, windlasses with buckets, etc.) shall have a continuous lining or lattice-work enclosure from top to bottom, of the nature of a shaft, such that the materials being transported cannot fall out of the shaft. The only openings left uncovered shall be those for loading and unloading, which shall not be higher than is necessary."

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

Hoists

"64. The hoist shaft may be built of timber and entirely covered with planks or enclosed in continuous mesh, the interstices of which shall not exceed 20 mm. in width or diameter.

When the equipment is such that there is no risk of materials falling during loading, unloading or hoisting, the shaft may, subject to the authorisation of the technical inspector of the Commissariat of Labour, be boarded in up to a height of 2 m. from the ground level or from the flooring supporting the shaft.

¹ See under Chap. I, § 1 (c) "Scaffold Materials and Construction".

66. The structural parts of hoist shafts erected in scaffolding shall be sufficiently strong and solid. They shall be kept in place by means of guys of proved strength for this purpose. Hoist wells close to scaffolding may touch it but not be fixed to it.

The management shall see that the cables are sufficiently taut at all times. The anchorage of cables shall be enclosed to protect them from deterioration."

(O. 27.3.1931.)

YUGOSLAVIA

"122. The openings at certain storeys of scaffolds for the transport of building materials shall be connected by a wooden shaft whenever the hoisting of the materials is done by mechanical means."

(R. 25.10.1921.)

(c) PERMANENT LIFT SHAFTS

UNITED STATES

California

"Order 1119. *Elevator shafts.* (a) All elevator shafts in which the elevators or cages are not in operation, and not enclosed with solid partitions and doors, shall be guarded on all open sides by standard railings and standard toeboards as specified in sections (a) and (b), Order 1141¹ on Stairwells and Stairs.

(b) Where there is a car in operation and persons are employed in an adjacent shaft, such cars shall be equipped with a bell or other signal which shall sound a warning while the car is in motion.

(c) During the construction of the walls enclosing the shaft, and the installation of the overhead machinery, overhead protection shall be provided at all times when persons are employed in the shaft.

(d) If one or more elevators are located in the same shaft and one elevator is put into temporary service before the others are completed, such elevator in use shall be separated from the other elevators by a continuous partition of solid material or of wire mesh."

(G.O. 1.7.1926.)

Pennsylvania

"(a) The shaftway and cars of hoists shall be constructed of material of ascertained soundness and capability to sustain safely the maximum load to be imposed upon them. The shaftway tower shall be cross-braced and strutted and well guyed or strongly anchored to the building. Shaftway towers shall be vertically straight and plumb."

(R. 1933, Rule 22.)

Wisconsin

"If two or more elevators are located in the same shaftway and one elevator is put into temporary service before the others are completed, then the elevator in use (together with its counter-weights) shall be separated from the other elevators by a continuous partition. This partition shall either be solid or consist of a screen of not less than No. 13 U.S. Standard Gauge wire with 1 in. mesh."

(G.O. 15.7.1933, Order 3533.)

¹ See under Chap. I, § 4 (b) "Temporary Stairs, etc."

(d) LANDINGS

GERMANY

Power-driven Building Hoists

A. General Rules

" 81. Persons employed at the loading places shall be safeguarded against falling objects by means of a protective roof, and in addition the entire danger zone shall be fenced off.

B. *Special Provisions for Platform Building Hoists with Scaffolding Shafts*

94. Utilisable approaches to the scaffolding shafts of building hoists that can be entered by persons shall be provided with doors at least 1.80 m. in height. The doors may be made of wire mesh with openings not more than 2 cm. wide, or of posts not more than 2 cm. apart. The doors shall be provided with an interlock actuated from the platform. Sliding doors automatically actuated from the platform shall not require interlocks. Vertically-sliding doors actuated by the platform shall not move at more than 0.3 m. per second.

95. Unused approaches shall be so fenced as to prevent leaning over or falling into the shaft.

96. On building hoists that cannot be entered by persons precautions shall be taken (toe-boards, etc.) that as far as possible prevent falling into the cage as a result of slipping, etc.

C. *Special Provisions for Building Hoists without Scaffolding Shafts*

99. Unless other measures are taken to fence off the hoistway, at every storey shall be provided a railing 1 m. high, which shall enclose the hoistway on all sides at such a distance that persons cannot reach it. Under the railing a toe-board shall be fitted. It shall be possible to move the railing only on the side used for access to the cage. The movable part of the landing shall not be removable. At the loading place the hoistway, unless only carriers are conveyed, shall be enclosed by a protective parapet at least 0.60 m. high.

(T.P. 8.6.1929.)

144. (1) All loading and unloading points which are more than 2 m. above the ground shall be provided with a railing and toe-board.

(2) Mobile parts of railings shall not be removable.

(3) If only materials are hoisted there shall be a strong parapet at least 60 cm. high below the mobile part of the railing."

(R. 1.1.1930.)

ARGENTINA

" 75. . . . the landing of every storey shall be protected."

(D. 14.1.1916.)

AUSTRALIA

New South Wales

Steam Cranes and Steam Hoists

" 17. The hoist-well in any building in course of erection shall, upon all floors, be enclosed with rails 2 ft. 6 in. in height; should a car or platform be in use in such well, the rails must be placed not less than 12 in. back from the edge of the well."

(A. 26.11.1912, Schedule, sec. 17.)

Builders' Hoists: General

"(d) All openings in floors, walls, or other parts of the building structure, through which materials are raised or lowered by means of a hoist, shall be fenced by guard-rails of sound Oregon of cross sectional dimensions of not less than 3 in. \times 2 in., fixed at a height of 3 ft. above the level of the floor or landing and 12 in. back from the edge of such opening."

(R. 17.9.1929, sec. 5.)

Platform Hoists used in connection with Building Operations

"(d) Sound timber guard-rails having cross sectional dimensions not less than 3 in. \times 2 in., shall be provided across all openings giving access to a hoist platform, and shall be fixed at a height of 3 ft. above the landing from which materials are loaded or unloaded. A guard-rail shall also be fixed on every landing, working platform, scaffold, stairway, or any part of the building or temporary structure facing an open side of a hoist platform. Every guard-rail shall be 12 in. back from the extreme projecting edges of the hoist platform. Guard-rails shall be kept in position at all times, except the guard-rail across the opening giving at any one time access to the hoist platform. When the hoist is stopped level with a landing or other part aforesaid, and the guard-rail is removed for working purposes it shall be replaced."

(R. 17.9.1929, sec. 6.)

Queensland

*Builders' Hoists: General Platform Hoists used in connection
with Building Operations*

As for New South Wales.

AUSTRIA

"19. The openings for loading and unloading goods hoists shall be constructed in such a way as to exclude the risk of persons or materials falling; and the lighting, whether natural or artificial, shall be adequate. At all such openings a notice shall be posted warning people not to lean over and forbidding the use of the hoist by persons."

(R. 7.2.1907.)

BELGIUM

"6. If the openings for the passage or operation of an appliance or load are dangerous to the employees, they shall be provided with railings and toe-boards or other adequate devices to prevent persons or objects of any kind from falling through them; if these devices are movable, they shall operate automatically as far as possible.

Further, each landing shall be fitted with a barrier or other closing device which cannot be kept open unless the cage or hoisting platform is stationary at the said landing or for the purpose of handling the load at that landing."

(R.O. 20.2.1933.)

BULGARIA

"48. . . . Entrances and exits of the shaft shall be fitted with gates which shall be kept closed except when required to be open for the purposes of operations."

(O. 4.5.1935.)

CANADA

Alberta

"174. Where hoists are used for raising materials for use in buildings, the shafts or openings shall be protected at each floor by a barrier not less than 3 ft.

nor more than 4 ft. from the level of the floor, and the barrier shall be placed not less than 2 ft. from the edge of the shaft or opening in which the hoist is operated; provided that upon the level or floor in actual use by such hoist such barrier shall not be placed across the openings used for entrance or exits to or from such hoists. Where material hoists are within 4 ft. of work under construction, the material hoistway shall be protected on sides next construction work by lattice with openings not more than 6 in. wide."

(R. 1928.)

DENMARK

Hoists for Building Materials

"3. At the ground level the shaft of the hoist shall be securely boarded up to a height of 1.9 m. on the sides not used for loading. On the sides used for loading materials there shall be a portcullis door, bar or similar contrivance that automatically closes the entrance when the platform is not at its lowest point. This barrier shall reach to not less than 90 cm. above the ground."

(N. 1.1.1928, Part I.)

Bucket Hoists for Concrete

"2. At the lowest landing the open side of the shaft shall be closed as far as possible, allowance being made for the operation of the hoist."

(N. 1.1.1928, Part II.)

UNITED STATES

California

Construction Material Elevators; Construction Material and Man Elevators

"(j) When cages are used in a tower outside of a building, each landing of all elevators shall be provided with a hinged horizontal bar, or bars, forty-two (42) inches above the floor.

"(k) When cages are used in an elevator shaft inside of a building the landings shall be protected with a solid partition at least six (6) feet high and all openings fitted with doors at least six (6) feet high."

(G.O. 1.7.1926, Order 1114.)

Ohio

"Section 106. All elevator and hoist shafts shall be equipped at each landing with gates not less than five and one-half ($5\frac{1}{2}$) feet high, with frames filled in with members not more than two (2) inches apart or with wire netting or expanded metal of not more than two (2) inch mesh.

Section 107. Elevator and hoist shaft gates that are not in continuous use shall be kept closed at all times, except when the elevator or hoist is stationed at a floor level for loading or unloading or watchmen stationed at openings to police or guard them.

Section 108. Sides accessible to workmen, other than gate sides, of elevator and hoist shafts at each landing stage shall be enclosed or properly protected to a height of six (6) feet. This does not apply to backs of ladders on outside towers, which ladders shall not be used when hoists are in operation.

Section 110. The landing platforms of all elevators or hoists shall be of sufficient strength to carry the maximum working loads imposed upon them without exceeding the allowable working stresses specified in section 23¹ and shall be equipped with guards-rails, toe-boards and side screens as provided in sections 239 to 245² inclusive of this code."

(S.R. March 1931.)

¹ Specifications not reproduced.

² See under Chap. I, § 1 (c) "Scaffold Materials and Construction".

Pennsylvania

“(b) Where landing platforms connect the shafting to the building, such platforms shall be provided with guard rails and toe boards.

(c) The shaftways of hoists shall have a solid or substantial grille or lattice work on all sides, not used for loading or unloading extending to a height of at least six (6) feet from each landing. The open spaces in the grille or lattice work shall not exceed two (2) inches at their greatest width. The entrance to the shaftway shall be protected by a hinged bar, placed at least eighteen (18) inches from the flush line of the shaftway. Where the entrances to the shaftways are exposed to hazard from falling materials, a substantially large and strong covering shall be provided.”

(R. 1933, Rule 22.)

FINLAND

“31. In order to prevent persons from traversing the path of the hoist, the lowest landing or loading stage shall be shut off when the cage is not at that level. In the case of a goods hoist, access may be prevented by means of a gate or bar automatically rising or falling as the hoist nears the ground or leaves each landing. Suitable appliances to prevent access shall likewise be placed at the topmost loading stage.

If a hoist is being used only between the loading and unloading stages, all intermediate landings shall be shut off.

A safety roof shall be constructed over the free sides of the path of the hoist, not less than 4 m. above the ground. The part of the path of the hoist which lies between this roof and the ground shall be completely enclosed, except for the openings for loading.

Whenever practicable the path of the hoist shall be fenced at every landing up to a height of not less than 2 m. on the sides where there are no openings for loading. A railing and toe-board shall be provided at every landing where this is possible, on its free and open sides. A clear space of not less than 10 cm. shall be left between the cage of the hoist and the landing in order to facilitate the movement of the cage”

(Res. 15.11.1927.)

ITALY

“10. The moving cage of goods and passenger lifts and elevators shall move within guides and be of a shape which makes it safe for the use for which it is intended. If shafts for hoists and their balance-weights communicate with stairs or passages, they shall be fenced in such a way that no one can inadvertently put his head or body into such shaft.

The openings of hoists shall be fitted with gates or barriers and preferably with such as close automatically.

The approaches to shafts shall in all cases close automatically on the bottom and top landings. Hoists in which barrows are conveyed shall be fitted with automatically closing gates at all landings.”

(M.C. 9.9.1925.)

LUXEMBURG

“23.

The landings and openings for the transportation of material shall have a fender board and shall be securely fenced. The lift wells shall as far as possible be enclosed in order to prevent accidents through the falling of materials.”

(O. 28.8.1924.)

MEXICO

“509. Places or enclosures where materials are hoisted and the shafts used for hoisting purposes shall be adequately fenced in to prevent the entrance

of workers who are not directly engaged in working the machinery used for such hoisting.

510. When work is carried on at night, the position of places and enclosures where materials are hoisted and of the shafts used for hoisting purposes shall be clearly indicated by red lights."

(R. 28.11.1934.)

SWEDEN

"(a) At places where the workers are exposed to the risk of injury by falling or from falling objects, the necessary protective devices shall be provided, in so far as the nature of the work allows thereof, e.g. openings in the floor, scaffolding, platforms, hoists and the like shall be suitably fenced, and staircases shall be provided with handrails."

(A. 12.6.1931, sec. 4.)

SWITZERLAND

Geneva

"130. At the ground floor the hoist well shall be enclosed by a fence 1.80 m. high on all sides except those giving access to the hoist.

131. All places giving access to the hoist above the ground level shall be closed by movable barriers which shall only open when the load is being taken in or out.

132. At all landings where the hoist platform stops for loading or unloading there shall be supports on which the platform can rest so that it shall not be suspended by the cable during loading or unloading. Exceptions shall be allowed in the case of lifting appliances with revolving platforms."

(R. 25.3.1930.)

CZECHOSLOVAKIA

"(2)

The only openings left uncovered shall be those for loading and unloading, which shall not be higher than is necessary.

(3) The said openings shall have guards to prevent persons or materials from falling from the scaffold into the well and to prevent persons from leaning dangerously over the well or walking under the loads being transported. The openings shall be well lighted at all times, either naturally or artificially.

(4) In the case of platform lifts, the gates or doors of the openings in the well shall be arranged to close automatically at least on the ground floor and on the storey which is highest at the time as the building progresses. The openings on the intermediate storeys, where neither loading nor unloading takes place, shall be permanently and securely closed."

(O. 26.3.1931, sec. 47.)

URUGUAY

"X. . . . Hoist openings on stairs or passages shall be fenced in such a way that no one can inadvertently put his head or body through the opening.

The openings of hoists shall be fitted with gates or barriers and preferably with such as close automatically."

(R. 14.4.1915, sec. X.)

YUGOSLAVIA

"125. . . . The openings for loading and unloading shall be fitted with barriers and shall, where necessary, be lighted."

(R. 25.10.1921.)

§ 3. — Ropes and Chains

GERMANY

“139. (1) Hoisting ropes and chains shall be fitted with safety hooks or securely fastened to the carrier.

(2) Pulleys shall be at least 2.50 m. above the highest unloading point unless some other precaution is taken against accidents.”

(R. 1.1.1930.)

“2. Round link chains used for lifting or fastening loads shall be tested chains within the meaning of the “Specifications for round-link chains” drawn up by the Association of German Engineers.¹ The chains shall be used and inspected in accordance with these specifications. The works’ or expert’s certificate concerning the tests required during manufacture shall be issued by the works or experts appointed by the Federation of German Mutual Accident Insurance Associations.”²

(R. 1.4.1934, Appendix 2 (h).)

AUSTRALIA

New South Wales

Hand Cranes

“14.
The gland irons, derricking, and hoisting ropes must be kept in good condition and closely looked over as often as possible. Where ropes show signs of bunching, stranding, excessive wear, or breaking of wires they must be at once discarded.”

(A. 26.11.1912, Schedule, sec. 14.)

Steam Cranes and Steam Hoists

As for *Hand Cranes*.

Hoists for Building Operations : Hoist Ropes and Rope Attachments

“(3) (a) An eye splice shall be formed in the end of the hoist rope for attachment to the hoist hopper, platform, or other vehicle by which loads are hoisted or lowered and such eye splice shall be made use of in the said attachment.

(b) If the hoist rope is secured to an eye bolt on the hopper, platform, or other vehicle by which loads are hoisted or lowered, the nut of such eye bolt shall be prevented from inadvertently turning relative to the eye bolt by fitting a split pin, having a diameter at least equal to $\frac{1}{8}$ of the bolt diameter, through the nut and eye bolt.

(c) The hoist rope shall be guarded in an effective manner where it leads from the hoist winch to the rope sheave at the tower base.

Steel Wire Ropes for all Types of Steam Cranes and Engines

14 A. This Regulation shall apply to such appliances as are defined in paragraphs (c) and (j) of section 3 of the Scaffolding and Lifts Act, 1912. That is to say, that in this Regulation:

Engine means machine, crane boiler, or other apparatus or contrivance used in erecting, demolishing, altering, repairing, cleaning, or painting

¹ See Standard Specification DIN 685, issued by the German Standards Committee.

² The works are appointed after consultation with the local State factory inspectors. For the time being the experts are those of the German Lloyd.

buildings or structures; and includes hand cranes, travelling cranes, and other similar apparatus or contrivance used in yards, quarries, or other places for the purpose of lifting or handling timber, iron, stone or other materials.

Steam crane means steam crane, electric crane, hydraulic crane, or any other power crane or hoist used in connection with building operations, or used in any place for the purpose of lifting or handling timber, iron, stone, or other materials.

(a) No person shall use on or in connection with a steam crane or engine in any district any steel rope which has not been tested in accordance with this Regulation or in respect of which the provisions of this Regulation as to the submitting of a test certificate or copy thereof have not been complied with.

(b) The breaking load of any rope used on steam cranes or engines, other than a rope used for guying purposes, shall not be less than six times the maximum dead working load thereon.

(c) (i) After the expiration of three months from the date upon which this Regulation shall come into force, every person acquiring a wire rope for use within a district on or in connection with an engine or steam crane shall, within twenty-four hours of acquiring such rope, submit to the Chief Inspector a test certificate, correct in all particulars, in respect of such rope, and such certificate shall be in Form F¹ annexed, and shall be signed by the manufacturer or vendor of the rope.

(ii) Where a full length rope has been cut into shorter lengths, and any person acquires for use in a district on or in connection with an engine or steam crane any such shorter length, he shall, within twenty-four hours of acquiring such shorter length of rope, submit to the Chief Inspector a document which shall be a true copy of a test certificate, correct in all particulars, in Form F¹ annexed issued in respect of the full length rope and signed by the manufacturer or vendor. The document shall be accompanied by a statutory declaration of the manufacturer or vendor that it is a true copy of the original test certificate issued in respect of such full length rope.

(iii) The original test certificate must be signed by the person witnessing the test, and such person must be the responsible testing officer of a licensed proving house, the testing officer of a Government Department or of a University or other recognised Engineering School; or the testing officer of a manufacturer of wire ropes who has a testing machine on his premises suitable for testing a sample of the completed rope.

(iv) Wire ropes shall also be tested by twisting the individual wires round themselves at least eight times, then untwisting and straightening them. The wires shall stand this test without breaking.

(d) No wire rope shall be used on any steam crane or engine if the rope shows signs of excessive wear, corrosion, or other defect, or if in any length equal to eight diameters of the rope the total number of visible broken wires exceeds 10 per cent. of the total number of wires in such rope.

(e) Eye splices, sockets, and rope anchorages shall be capable of withstanding 95 per cent. of the guaranteed breaking strength of the rope and/or ropes to which they are attached.

(f) When a load is supported on more than one part of rope the tensions in the parts shall be equalised.

(g) An eye splice shall be made round a thimble and shall have at least three tucks with a whole strand of rope and two tucks with one-half of the wires cut out of each strand, made under and over against the lay of the rope. Each such splice shall be tightly drawn and neatly made.

¹ Not reproduced.

(h) The guaranteed breaking load of a wire rope used as a guy rope shall be not less than four times the dead working load on such rope, assuming that only one guying rope is opposing the load. Guying ropes may be made from basic open hearth steel.

(i) The number of dead turns of rope on the rope drum of any steam crane or engine shall be not less than two when the fall rope is at the extreme limit of its downward travel."

(R. 17.9.1929.)

Queensland

Wire Ropes

"(19) The hoisting, derricking, and guying ropes, unless otherwise specified by the purchaser, shall be in accordance with B.S.S. No. 302, Crane Ropes, but the 6×61 construction shall not be used, and guying ropes may be made from Basic Open Hearth Steel. Ropes shall be made from wire of 80-110 tons per square inch tensile breaking strength.

The breaking load of the lifting and derricking ropes shall be not less than six times the maximum dead working load thereon.

The breaking load of a guying-rope used for Guy Derrick cranes shall be not less than two and a half times the maximum tension induced therein under the conditions previously described on the assumption that only one guying-rope is opposing the load.

Note. — The minimum breaking load for guying-ropes laid down in this paragraph is made on the assumption that in service the guys will be spaced not more than 60 degrees apart in plan.

When a load is supported upon more than one part of rope, the tensions in the parts shall be equalised.

Eye-splices, sockets, and rope anchorages shall be capable of withstanding 95 per cent. of the guaranteed breaking strength of the rope and (or) ropes to which they are attached.

A thimble or loop splice shall have at least three tucks with a whole strand of the rope and two tucks with one-half of the wires cut out of each strand, made under and over against the lay of the rope. The splice shall be tightly drawn and neatly made.

Arrangements entailing reverse bends shall be avoided as far as possible.

Dustproof and waterproof ball-swivels shall be provided, to prevent the accumulation of twist under service conditions.

The derricking rope shall be of sufficient length to permit the jib being raised from or lowered to the horizontal position during the erection and inspection of the crane or hoist without the assistance of the hoisting rope.

The derricking tie-rod shall be arranged so as to be clear of the structure during the operation."

(R. 24.12.1930.)

Hoists for Building Operations: Hoist Ropes and Rope Attachments

As for New South Wales.

AUSTRIA

"17. In building operations, apart from chains only flexible ropes made of hemp, cotton or wire shall be used.

Ropes and chains shall be inspected from time to time, in respect of quality and strength, by experts. Faulty chains and ropes shall be adequately repaired forthwith, or if this cannot be done in a sufficiently reliable way, they shall be replaced. Ropes and chains of insufficient strength shall not be put to further use.

Ropes with ordinary hooks shall not be used for hoisting materials in containers."

(O. 7.2.1907.)

BELGIUM

"3. The chains, hooks, cables and other movable gear used for slinging, lifting and transporting loads shall have a serial number, if possible stamped in the metal, rendering it possible by means of a register to ascertain the name of the person supplying the gear, the date on which it is taken into use, the maximum load permissible, and (if the nature of the gear renders this necessary) the dates on which it has been annealed.

.....

13. The various parts of hoisting appliances shall be maintained in perfect condition.

The chains, hooks and similar gear used for slinging, lifting and transporting loads shall be annealed carefully whenever there is reason to suspect, owing to the pressure and character of the work done, that the quality of the metal has deteriorated; annealing shall also be effected at the request of the employer's inspectors; each annealing shall be entered in the register mentioned in section 3.

Unless a special authorisation is granted by the competent service, the interval between two successive annealings shall not exceed twelve months for chains, hooks and similar gear in regular use if they are made of metal not more than 12.5 millimetres thick, or twenty-four months if they are made of metal more than 12.5 millimetres thick.

In the case of appliances which are only rarely used, annealing need not be effected until the expiry of a period such that the work done with the said appliances is equivalent to the work which would have been done with them if they had been in regular use for a period of twelve or twenty-four months, as the case may be, according to the distinction laid down in the preceding paragraph.

If hooks and similar gear are arranged in such a manner that they are operated without suffering shocks, or if the nature of the metal used in them is such that there is no reason to fear any deterioration in the quality of the metal, the periodical annealings shall not be compulsory.

Owners of hoisting apparatus shall not be entitled to avail themselves of the last preceding provision unless the inspector mentioned in section 14¹ has certified in his reports that the appliances satisfy the conditions laid down for exemption from the compulsory periodical annealings, and further, that the condition of the metal is such that annealing is not necessary."

(R.O. 20.2.1933, amended by R.O. 11.9.1933.)

BULGARIA

"49. . . . The cables of hoisting gear shall have a safety coefficient of five. They shall be tested once every two weeks with a double load."

(O. 4.5.1935.)

DENMARK

Hoists for Building Materials

"4. The rope carrying the platform shall be such that when it is bearing the platform and the maximum load the sum of the tensile and bending stresses shall not exceed one-fifth of the tensile strength of the rope."

(N. 1.1.1928, Part I.)

UNITED STATES

California

Construction Material Elevators; Construction Material and Man Elevators

"(g) All hoisting cables shall be not less than crucible steel grade and shall be so constructed of wires and strands of wires as to be equal in flexibility to standard crucible steel hoisting rope composed of six (6) strands of nineteen

¹ See under § 6 "Maintenance, Inspection and Testing".

(19) wires each. No hoisting cable less than one-half ($\frac{1}{2}$) inch in diameter shall be used.

(r) All hoisting cables shall have a factor of safety of at least six (6) based on the ultimate strength as given by the cable manufacturer.

(s) No cable shall be used in which more than ten (10) per cent. of the wires are broken in any one foot of length.

(t) Cable fastenings shall be substantially and securely made and in such manner as to provide strength equal to the strength of the cable. When fastened with clamps, not less than three (3) such clamps of approved type shall be used. All sharp edges shall be prevented from coming into contact with the cable.

(u) The contractor or other responsible person using hoisting cables shall provide for frequent and thorough inspection of all cables and fastenings."

(G.O. 1.7.1926, Order 1114.)

Derricks

"(c) All wire cables, chains, ropes and blocks shall be of sufficient size and strength to safely raise, lower or sustain the superimposed load in any position.

(d) The maximum allowable working load of new cables, chains and ropes shall be based on manufacturers' tables.

(e) Cables or ropes shall be attached to drums in a manner not to interfere with proper winding.

(f) Cables shall be secured with at least three clamps, of fastenings of approved type.

(g) All cables or ropes leading from engines or through floor openings shall be substantially guarded."

(G.O. 1.7.1926, Order 1135.)

"Order 1136. *Slings*. (a) The slings on derricks, or other hoisting apparatus, shall be made of wire cable, chains or manila rope of sufficient strength to carry the imposed loads, and double slings shall be used on all horizontal loads over twelve (12) feet in length when composed of two or more pieces of material."

(G.O. 1.7.1926.)

Ohio

See under Chap. 1, § 5, "Ropes and Chains".

Pennsylvania

"(g) Cables shall conform to the specifications set forth in Rule 21.¹ Drums and sheaves used in connection with hoists shall have a diameter equal to at least twenty-five (25) times the diameter of the wire cable used except that existing drums and sheaves may be continued in use at the discretion of the Department."

(R. 1933, Rule 22.)

Wisconsin

"3. *Equipment*. Wire rope not less than $\frac{3}{8}$ in. in diameter shall be used as the hoisting medium in connection with all mechanical powered hoists. All rope used for hoisting purposes shall conform to the requirements of Order 3532.¹

Every wire rope shall be fastened to the load sling or anchorage (in the case of guy rope) by clip connection, using not less than three clips to fasten the free end to the standing portion of the cable, or shall be fastened in the manner required for elevators. All wire rope fastenings shall be such that not less than 80 per cent. of the strength of the cable is developed."

(G.O. 15.7.1933, Order 3529.)

¹ See under Chap. I, § 5 "Ropes and Chains".

FRANCE

"4. The suspension hooks shall be such as to prevent their loads from being accidentally unhooked.

6. No chain, wire rope or textile rope shall in ordinary use be made to bear a load exceeding one-sixth of its breaking load.

For exceptional purposes, all special arrangements which may be necessary shall be made to secure workers against the risks of accidents due to breakage of the chain or rope."

(D. 9.8.1925/26.11.1934.)

GREAT BRITAIN

"11. (a) Every hoisting or derricking rope or chain shall be securely fastened to the barrel of the crane, crab or winch with which it is used.

(b) Each temporary attachment or connection of a rope, chain or other appliance used in the erection or dismantling of a crane shall be secure.

(c) No rope shall be used over a pulley block if its diameter exceeds the width of the grooves of the pulleys or pulleys in the block.

13. Every chain, ring, hook, shackle and swivel for hoisting or lowering shall:

(a) Have been tested;

(b) Be inspected by the foreman or other responsible person immediately before each occasion on which it is used in hoisting or lowering, unless it has been so inspected within the preceding three months;

(c) If made of iron and if in general use, be annealed once at least in every 14 months unless it has been subjected to such other treatment as the Secretary of State may sanction, and

(d) Be legibly marked in plain figures and letters with an identifying number or description and with the safe working load.

Steel chains, rings, hooks, shackles, swivels, straps and gland irons shall be suitably heat treated after manufacture and before use.

The prescribed particulars of every such chain, ring, hook, shackle and swivel shall be entered into or attached to the prescribed Register.

Provided that the above requirement (c) as to the periodical annealing of iron parts shall not apply to the undermentioned parts:

Hooks, shackles or swivels having screw threaded parts or ball bearings, or any hook permanently attached to a block or pulley.

Bordeaux connections.

14. Every hook used for hoisting or lowering shall either be provided with an efficient catch to prevent the displacement of the sling or load from the hook or shall be of such a shape as to reduce as far as possible the risk of such displacement.

15. (a) Where double or multiple slings are used for hoisting or lowering purposes, the upper ends of the slings shall be connected by means of a shackle or ring and not be put separately into a lifting hook. This requirement shall not apply when the total load lifted or lowered is less than one half of the safe working load of the hook.

(b) No chain which has a knot tied in it shall be used for hoisting or lowering any load.

(c) Every chain sling used for hoisting or lowering a load shall be securely attached to the hook of the crane or other lifting appliance by means of a ring, shackle, link or hook. A chain which is attached by wrapping round the lifting hook shall be deemed not to be securely attached."

(R. 30.9.1931.)

IRISH FREE STATE

" 34.

Every hoisting rope shall be securely fastened to the barrel of the crane, crab or winch with which it is used.

35.

No rope shall be used over a pulley block if its diameter exceeds the diameter of the grooves of the block.

37. Every chain used on the premises for hoisting or lowering shall:

- (a) Have been tested;
- (b) Be inspected by the foreman or other responsible person immediately before each occasion on which it is used in hoisting or lowering unless it has been so inspected within the preceding three months;
- (c) If in general use, be annealed once at least in every 14 months unless it has been subjected to such other heat treatment as the Secretary of State may sanction; and
- (d) Shall be legibly marked in plain figures and letters with an identifying number or description and with the safe working load of the chain.

The prescribed particulars of every such chain shall be entered into or attached to a register which shall be kept on the premises or at the head office of the employer of the person or persons using the chain.

This register shall at all reasonable times be open to inspection by an inspector and the employer shall send to an inspector such extracts therefrom as the inspector may from time to time require.

42. Every hook used for hoisting or lowering shall either be provided with an efficient spring catch to prevent the displacement of the sling from the hook or shall be of such a shape as to reduce as far as possible the risk of such displacement."

(R. 5.3.1930.)

LUXEMBURG

" 15 Hemp and wire ropes and chains shall be tested regularly at as frequent intervals as possible in respect of their condition and maximum permissible load, and if necessary shall be repaired or replaced immediately. During frosty weather in particular, precautions shall be taken in the use of hemp ropes.

24. Lift ropes shall be strong and shall be provided with safety catches."

(O. 28.8.1924.)

POLAND

" 27.

(3) Under ropes and chains used to tie or suspend materials, packing (for example wooden wedges or rags) shall be placed to prevent injury to the ropes or chains during hoisting operations."

(D. 23.5.1935.)

CZECHOSLOVAKIA

" 45. (1) In constructional operations, in addition to chains, only flexible cables of hemp, cotton or wire shall be used.

(2) The sound condition and safe working load of cables, ropes and chains shall be ascertained by expert examination before use on each occasion.

Chains and ropes which are damaged or otherwise defective shall be repaired properly at once, or replaced if it is found impossible to repair them adequately.

(3) Chains and ropes the safe working load of which is insufficient for the loads to be moved shall not be used.

(4) In the raising and lowering of materials in tubs, chains and ropes shall not be used with ordinary hooks, but shall be fitted with safety hooks (double bent hooks, swivel hooks, spring hooks, etc.).

(5) Special care shall be taken in lengthening and splicing wire ropes and fitting slings to ropes. Ropes shall not be joined merely by means of knots.

(6) When sharp-edged objects fastened to cables, ropes or chains are being conveyed, the edges of such objects shall be safeguarded by a special covering in order to prevent any slipping of the cable, rope or chain and any chafing thereof.

(7) The attachment of loads for the purpose of raising or lowering them or transporting them in any other manner shall always be effected by experienced persons."

(O. 26.3.1931.)

§ 4. — Protection of Machinery and Electrical Equipment

GERMANY

Power-driven Cranes: General

"29. The safety regulations concerning electrical plant (chapter 4)¹ shall apply to electrical equipment and its use.

30. In the case of multiple-motor cranes, the distribution wiring on the driver's stand shall be so arranged that the leads, with the exception of leads for lighting, for the lifting magnet and any pressure indicators (lamps, volt meters), are carried first to a main switch and from there to the various fuses and automatic switches.

31. In the case of trolley wire switches which are at ground level and accessible to the public, the switch shall be so protected as to exclude the possibility of its being turned on in error or by an unauthorised person.

32. Switchboards shall be so covered as to prevent contact with current carrying parts at the back.

33. Power wires laid in underground conduits shall be so laid or covered as to prevent any longitudinal contact from without or contact from objects falling into the conduit."

(R. 1.4 1934, Appendix, (h).)

AUSTRALIA

New South Wales

"(b) Sheet metal guards constructed to the approval of the Chief Inspector shall be provided for all exposed gears and reciprocating or revolving parts and each guard shall be capable of supporting without permanent distortion a weight of 168 lbs. placed in any position on it.

(d) All projecting keys, set screws, and other projections in exposed revolving parts shall be removed, made flush, or guarded by a stationary metal cover.

(e) All exposed revolving collars shall be cylindrical and screws or bolts used in collars shall not project beyond the periphery of a collar."

(R. 17.9.1929.)

¹ The regulations referred to are contained in the general safety regulations of the Mutual Accident Insurance Associations for the iron and steel trades.

Queensland

Cranes and Hoists

" 25.
(c) Gearing shall be guarded so as to prevent injury to persons and damage by ropes or otherwise."

(R. 24.12.1930.)

AUSTRIA

" 20. If the driving mechanism of hoists, bucket hoists, cranes, and the like is not sufficiently protected by its position, it shall be fenced. All toothed gearing which is in an accessible spot or which is exposed to inadvertent contact shall be covered.

If electric hoists are used live conductors and the equipment shall be securely protected against contact with unauthorised persons."

(O. 7.2.1907.)

CANADA

Alberta

" 90. All exposed metal parts, on electrically operated cranes, and which do not carry current, including handles, conduits, covers, motor-frames, the entire frame of the crane and tracks shall be permanently and effectively grounded.

.

93. All gears, pinions, and set-screws shall be guarded.

94. All sheaves where workmen could be caught between cable and sheave shall be guarded.

.

96. All frictions shall be guarded.

97. Main rod on hoisting engine shall be guarded."

(R. 1928.)

UNITED STATES

California

Construction Material Elevators; Construction Material and Man Elevators

" (3) Shields or screens shall be provided to protect the operator from coming in contact with crank, connecting rod, valve rod, steam jam cylinder, gears or other moving parts while he is standing or sitting at his place of duty."

(G.O. 1.7.1926. Order 1114.)

Ohio

" Section 104. The operating machinery of all hoisting engines shall be substantially covered to provide protection to the operator thereof when exposed to falling material or objects, and to inclement weather. All supporting parts and operating machinery shall be set upon secure and substantial foundations."

(S.R. March 1931.)

Wisconsin

Order 3537. Electrical Hazards

"

2. *Grounding.* Where equipment is connected to a source of electrical power, all metal or other current conducting, non-current carrying, parts shall be grounded. In the case of electric hoists, the friction levers, controller handles, foot brakes and other non-current carrying parts shall be grounded.

All parts of equipment, such as steam shovels, derricks and similar machinery and devices, which are moved or put in use in the vicinity of conductors carrying electrical current, shall be grounded so far as practicable.

Every ground shall be made in accordance with the provisions of the Wisconsin State Electrical Code."

(G.O. 15.7.1933.)

FINLAND

" 30.

The toothed wheels and friction wheels, belts and belt pulleys and other dangerous parts of the machinery and transmissions of lifting apparatus shall have suitable guards "

(Res. 15.11.1927.)

GREAT BRITAIN

" 45. The fly-wheel of every engine, all dangerous parts of the machinery, and every part of the mill-gearing shall be securely fenced, or be in such a position or of such construction as to be equally safe to every person employed as they would be if they were securely fenced. Every water-gauge glass on a steam-boiler shall be adequately protected by a guard. All electrical apparatus and electrical conductors shall be so installed and protected as to prevent danger to any person employed."

(R. 21.6.1926.)

LUXEMBURG

" 24. The driving machinery of lifts and hoists, mortar mixing machines, etc. shall be enclosed, and the cogwheel gear of winches shall be covered."

(O. 28.8.1924.)

NEW ZEALAND

" 16. (1) The moving parts of all machinery shall be so guarded as to afford adequate protection to all persons working the machinery or in connection therewith, or who may be in the vicinity thereof."

(A. 2.10.1928.)

POLAND

" 4. (1) The mechanical equipment on the building site shall be made inaccessible to all persons not directly employed in its operation, by means of hoarding, planking, covering, protective roofs, mesh, etc.

2. The operation of mechanical equipment and the performance of dangerous work shall be entrusted to workers who are well acquainted with such equipment or work. In addition, the indispensable arrangements and precautions shall be taken to prevent any accidents occurring to the workers employed thereon."

(D. 23.5.1935.)

SWEDEN

(g) Motors, machinery, transmission apparatus and other mechanical equipment the movable parts of which involve danger to the workers shall be fenced or otherwise arranged so that the danger involved is eliminated as far as possible."

(A. 12.6.1931, sec. 4.)

SWITZERLAND

Geneva

" 135. Engines shall be fitted with protective casing. Boards shall be placed below driving belts to prevent them from falling.

When driving belts cannot be placed high enough to allow of persons passing safely below them, precautions shall be taken by enclosing them at all accessible points.

Belts shall not be disconnected by hand when in motion.

136.

Appliances for disconnecting driving belts shall be fitted with a catch in both positions to prevent inadvertent throwing in or out of gear.

The smearing of the belts with resin shall always be done on the lower length of the belt and close to the pulley which this length is leaving."

(R. 25.3.1930.)

CZECHOSLOVAKIA

"49. (1) The driving mechanism of lifts, hoisting apparatus, cranes and similar appliances, and all toothed gears, pulleys, etc., shall be directly safeguarded at all places where workers are likely to pass by means of suitable and reliable fencing, covers, and the like.

(2) The drums of hoists shall be flanged to prevent the rope from slipping off.

(3) Where an electric drive is used, the conductors of the current and all apparatus appertaining thereto shall be securely guarded to prevent the contact of unauthorised persons therewith. Bare or insufficiently insulated wires shall not be used."

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

Travelling Cranes (American Derricks, Wharf Cranes, etc.)

"(f) All pinions and toothed wheels on cranes shall be encased."

(O.5.5.1930, sec. 136.)

Fixed Cranes of the American Derrick Type

"(d)
All pinions and toothed wheels shall be suitably encased.
All motors of electric winches shall be earthed."

(O. 5.5.1930, sec. 138.)

§ 5. — Use of Hoisting Appliances

(a) SIGNALLING

GERMANY

"141. If the loading and unloading points are not visible from the attendants' stand, some method of signalling shall be arranged."

(R. 1.1.1930.)

AUSTRALIA

New South Wales

Platform Hoists used in connection with Building Operations

"(e) An efficient and safe signalling arrangement shall be provided for the purpose of transmitting signals to the hoist driver as to when to raise and to lower the hoist platform, and also as to when to stop the motion of the hoist platform. Such signalling system shall be arranged so that its operation must be intentional upon the part of the operator.

No person shall operate a builder's hoist signalling device unless he is duly authorised in writing so to do by the employer of the hoist driver.

(f) A warning bell, the sound of which will be distinctly and continuously heard when the platform is moving in any position of its travel, shall be fitted to every hoist platform."

(R. 17.9.1929, sec. 6.)

BELGIUM

"9. The person in charge of a hoisting appliance moving loads horizontally shall not begin moving loads until he has given a warning signal to the employees working near the path which the load must follow. He shall take the same precautions when the appliance is travelling without a load and the suspension gear is liable to cause an accident to any person.

The said signal shall not be compulsory in cases where operations are carried out in accordance with the instructions of a person in charge whose special duty it is to see that they are effected without danger to the employees."

(R.O. 20.2.1933.)

CANADA

Alberta

"71. An approved foot or hand-operated gong or other effective warning signal shall be placed in a location convenient to the operator and be securely fastened."

(R. 1928.)

DENMARK

Hoists for Building Materials

"8. There shall be a signalling device connecting the unloading points with the winding engine, so that those who are loading or unloading can clearly indicate to the engine-man when the platform is to be lowered."

(N. 1.1.1928, Part I.)

UNITED STATES

California

"Order 1118. *Construction Hoisting Signals.*

(a) Bell, whistle or electric signals shall be provided on all elevators, hoists and all other hoisting machines, except hoists for derricks where the hoist operator has a clear and unobstructed view of the derrick and signalman, in which case a manual system of signalling may be used.

(b) The following signals shall be used on all elevators and hoisting machines:

- One bell or whistle, to stop.
- Two bells or whistles, to go up.
- Three bells or whistles, to go down.
- Four bells or whistles, to go slow.

(c) Whenever derricks are used for hoisting structural steel or other materials, the following code of signals shall be used:

- One bell, to hoist.
- One bell, to stop (if in motion).
- Two bells, to lower.
- One bell, to raise boom.
- Two bells, to lower boom.

Note. — The above signals are used with two different sounding bells.

If swing lines are used on booms:

- Three bells or whistles, shall be to the right.
- Three bells or whistles, shall be to stop.
- Four bells or whistles, shall be to the left.

(d) A copy or copies of the signal code as designated in sections (b) and (c) of this order, shall be posted in a conspicuous place on each construction job where elevators, hoisting machines or derricks are used.

(e) All cords, wires or other devices used in connection with signal systems shall be adequately protected in conduits and against unauthorized operation. In cases where electric signals are used, all wiring shall be adequately protected in conduits."

(G.O. 1.7.1926.)

Ohio

"Section 105. Hoisting apparatus, such as elevators for brick, concrete and other materials, except where the operator has a clear and unobstructed view, shall be equipped with efficient signaling devices. Manual signals are permitted on boom derricks or other apparatus for setting material such as steel, stone, timber, etc. where close control is necessary."

(S.R. March 1931.)

Pennsylvania

"1. Signal systems shall be provided and used. They shall be so installed and connected to shaftway gates or doors as to be inoperative when any gate or door is in an open position."

(R. 1933, Rule 22.)

Wisconsin

"Bell, whistle or electric signals shall be provided in connection with all hoists where an operator is stationed at the power device, and in connection with derricks wherever practicable. Hoist signals shall be so located as to minimize the possibility of signalling accidentally and that they cannot be operated by a person standing on the hoist."

(G.O. 15.7.1933, Order 3531.)

FINLAND

Hoists

"31. . . . signalling apparatus communicating with the hoistman shall be provided at every landing stage in use."

(Res. 15.11.1927.)

GREAT BRITAIN

"17. . . . No person under 18 years of age shall be employed to give signals to a crane driver.

18. When any hoisting or lowering is performed by means of a crane and the crane driver or person operating the crane is unable to see the load in all its positions, one or more look-out or signal men shall be stationed so as to see the load in its starting and landing positions and give the necessary signals to the crane driver or person operating the crane. Provided that this requirement shall not apply to deep well sinking.

19. Every signal for hoisting or lowering shall be such as can be readily heard or seen, and shall be distinctive in its meaning to the person who has to act upon it. Where a sound signal is used, the signal shall be made by an efficient gong, whistle or electric apparatus, or other efficient means. Every signal wire shall be protected from accidental interference."

(R. 30.9.1931.)

IRISH FREE STATE

"39. When any hoisting or lowering is performed by means of a crane which is in such a position that the crane driver is unable to see the load in all its positions a look-out man shall be employed to give the necessary signals to the driver."

(R. 5.3.1930.)

(The other provisions concerning signalling in the Regulations of 5.3.1930 are identical with sections 17 and 19 of the British regulations.)

MEXICO

“ 519. Every travelling or swivelling crane shall be fitted with a bell or whistle, worked by the driver, by means of which clearly audible signals can be given for the various operations.”

(R. 28.11.1934.)

UNION OF SOVIET SOCIALIST REPUBLICS

Travelling Cranes (American Derricks, Wharf Cranes, etc.)

“ (b) As a general rule the crane crew shall consist of a driver, an attendant and a fireman (in the case of steam cranes). The driver shall not carry out any operation with the crane except on receipt of a signal from one definite person, namely the attendant. When the attendant cannot see the loading or unloading point, a second attendant shall be employed. The management shall work out an exact system of signals with which the driver shall be acquainted.”

(O. 5.5.1930, sec. 136.)

(b) INSTALLATION AND PROTECTION OF DRIVER'S STAND

GERMANY

“ 142. (1) Insured persons employed at the loading and hoisting points shall where necessary be safeguarded by protective roofing. The danger zone shall moreover be fenced off.”

(R. 1.1.1930.)

Power-driven Cranes: General

“ 25. The driver's stand shall be so placed that the driver has an uninterrupted view of the whole field of operation. The stand shall be sufficiently spacious for the various appliances to be operated and kept in repair without difficulty. Closed cabs on cranes used in the open air shall be fitted with heating equipment.

27. In undertakings in which fire is used, the driver's stand shall be enclosed in fire resisting material.

28. In the case of electric cranes the floor of the driver's stand shall have a wooden covering or some other covering giving insulation against leak currents.

Jib Cranes

103. With a view to preventing the crushing of persons while the crane is slewing, the driver's stand of jib cranes shall be so designed or enclosed that tools and other objects cannot be stored in it. For the storage of tools a tool box shall be so installed that, when using it, persons cannot be endangered by the movement of the crane.”

(R. 1.4.1934, Appendix, 2 (h).)

AUSTRIA

“ 20. Hoists, bucket hoists and similar lifting appliances shall be so constructed so as to exclude any danger to persons employed below them from falling

materials. Sufficiently strong protective roofing shall be provided on the lowest floor."

(O. 7.2.1907.)

BELGIUM

"7. The driver's or engineman's cab on travelling cranes and similar transporting appliances shall be arranged so that the driver or engineman can at any moment conveniently watch the load and the places over which it must pass.

If it is impossible to comply with this requirement, operations shall not be effected otherwise than at the orders and in accordance with the instructions of a person responsible for ensuring that such operations are effected without danger to the employees."

(R.O. 20.2.1933.)

CANADA

Alberta

"(74). Access to and exit from the crane-cage shall always be by stationary ladders, stairways, or platforms provided for the purpose. Crane-men shall keep their hands free when going up and down ladders.

(75) Safe means shall be provided for passing from crane-cab to bridge footwalks, and shall consist of fixed ladders or stairs with handrails.

(76) Cages shall be kept free of clothing and other personal belongings. Tools, extra fuses, oil-cans, waste and other articles necessary in the crane-cage shall be stored in a tool-box and not left loose in or about crane.

(77) An approved fire-extinguisher shall be carried in the crane-cage for use in case of fire."

(R. 1928.)

UNITED STATES

California

Construction Material Elevators; Construction Material and Man Elevators

"(y) Every hoisting engine, motor hoist and air compressor used in building construction shall be properly covered over to protect the operator from all falling material, but nothing shall interfere with the operator's view of the steam and water gauges.

(z) Shields or screens shall be provided to protect the operator from coming in contact with crank, connecting rod, valve rod, steam jam cylinder, gears or other moving parts while he is standing or sitting at his place of duty."

(G.O. 1.7.1926, Order 1114.)

Wisconsin

"Every hoisting engine, air compressor, concrete mixer or other machine used in construction work and which requires an attendant, shall be covered over to protect the operatives stationed at the machine, except where the horizontal distance from such machine to the nearest point where work is being done is at least one-half the vertical height of such point above the machine. The covering shall be solid, shall extend not less than 4 ft. outside the normal working area of the attendants at the machine, and shall be constructed to support a uniform load (in addition to the weight of the covering) of not less than 30 lbs. per square foot over the entire cover or roof."

(G.O. 15.7.1933.)

FRANCE

"8.
Workers in charge of winches installed on the ground for hoisting materials

shall be protected against falls of tools, small material or similar objects by a safety roof of adequate solidity.”

(D. 9.8.1925/26.11.1934.)

GREAT BRITAIN

“(l) The crane driver’s cab shall, where reasonably practicable, before the crane is put into general use, be completely erected, or other adequate provision made for the protection of the driver from the weather.

(m) During cold weather the cabin of each power-driven crane in use shall, where reasonably practicable, be adequately heated by suitable means.”

(R. 30.9.1931, sec. 5.)

ITALY

“9. In the construction of new buildings or during extensive repairs or alterations to existing buildings, the points at which workers employed in hoisting materials are permanently occupied shall be protected by some suitable roofing not more than 3 m. above the ground level.”

(R.D. 27.5.1900.)

MEXICO

“518. Travelling cranes operated from the crane itself shall always have a cabin for the driver, in which all the controls shall be placed. The cabin shall be of appropriate size, with a roof and a guard-rail, and shall be so placed that it can easily be seen from the ground and that the driver has a clear field of vision. Access to the cabin shall be permitted only to the driver, repairmen and greasers; in no case shall the crane be worked by persons who are not authorised to operate it and experienced in such work. The same rule shall apply to swivelling cranes.”

(R. 28.11.1934.)

SWITZERLAND

Geneva

“136. The driver shall be provided with a roofed stand for operating the machinery. . . .

137. From his stand the operator shall be able to watch the containers and platforms over their whole course.”

(R. 25.3.1930.)

CZECHOSLOVAKIA

“51

(2) A safe standing place shall be provided for the hoist attendant, such that from it he can watch the transport of the load by the hoist.

53

(6) The permanent stations of crane drivers and hoist attendants shall be properly protected against the effects of the weather.”

(O. 26.3.1931.)

URUGUAY

“XVIII. Workers operating hoists shall remain at such distance as to avoid being injured by falling objects.”

(R. 14.4.1915, sec. XVIII.)

(c) TRANSPORT OF GOODS

GERMANY

“139

3. Timber, iron parts, etc., shall be so fastened as to prevent their slipping out of the rope or chain holding them. Objects which cannot be roped or chained safely shall be hoisted in suitable containers.

4. Guide ropes shall be attached to beams, girders and other long objects.

5. Containers shall never be loaded above the brim and shall not be overloaded.

6. So far as possible the load shall be brought directly below the hoisting appliance before hoisting begins.

142.

2. Precautions shall be taken to prevent the load from catching against scaffolding or building parts during hoisting.

143. Except where necessary, persons shall not remain underneath a load which is being hoisted."

(R. 1.1.1930.)

Jib Cranes

" 110. When the purpose and construction of the crane so allow, the available safety devices against overturning shall be used. If rail tongs are used, care shall be taken to see that the rails are adequately fastened.

111. (1) The load shall only be raised vertically. The dragging of loads easily leads to the overturning of the crane.

(2) It shall be prohibited to slew the jib too quickly or to slew it over a raised rail, owing to the risk of overturning.

112. During the lowering of loads the load-brake shall be applied evenly and slowly, because sudden application multiplies the strain and may cause the crane to overturn.

113. (1) When the load is being carried over a considerable distance or over curves or points, the jib shall always lie in the direction of travel. In such cases the load shall be under constant observation.

(2) Curves shall be passed at slow speeds.

114. (1) When there is a strong wind, the load shall be less than the indicated maximum load"

(R. 1.4.1934, Appendix, 2 (h).)

AUSTRIA

" 21. The movement of persons beneath swinging loads shall be reduced to a minimum.

27. The carrying, loading and unloading of heavy loads shall be effected under skilled supervision. Care shall be taken that the conveying and loading equipment, travelling and hoisting gear and the rails, etc., are in safe condition, so that neither the operations, nor workers or passers-by are endangered."

(O. 7.2.1907.)

BELGIUM

" 5. The necessary measures shall be taken to prevent the fall of the load or of parts thereof.

If it is impossible in practice to carry out this provision owing to the working principle of the hoisting apparatus, the necessary measures shall be taken to ensure that the fall of the load or of any part thereof shall not give rise to danger to the employees."

(R.O. 20.2.1933.)

CANADA

Alberta

" (70) Floorman shall, wherever possible, walk ahead of moving load and warn people to keep clear of it.

(82) Wherever loads are to be carried over a long distance to a high position they shall be carried as close to the floor as possible until final location is reached; load shall then be lifted to desired height.

(173) No lumber or timber shall be hoisted in a single sling."

(R. 1928.)

FINLAND

" 30.
Working and passing below loads suspended from cranes shall be prohibited.

31.

When long goods are being raised on to scaffolding by means of a hoist, the load shall be guided by means of special ropes and shall be prevented from catching in the scaffolding. Traversing the zone over which the load is moving shall be prohibited."

(Res. 15.11.1927.)

FRANCE

" 7. Measures shall be taken, and the necessary orders given, to ensure the safety of the workers when hoisting and handling appliances are being used.

8. Every precaution shall be taken to prevent falls of objects which are being moved by hoisting appliances.

Objects which overhang the edge of the kibble shall be fastened to the cable, the chain or the ropes."

(D. 9.8.1925/26.11.1934.)

GREAT BRITAIN

" 16. No load shall be left suspended from a crane, crab or winch unless there is a competent person actually in charge whilst the load is so suspended.

25. A person employed in lowering a load by means of a crab not operated by mechanical power (or, where such lowering is performed by a gang, the person in immediate charge of such gang) shall see that the descent of the load is checked by the use of the rotating handle or handles and not by means of the brake alone."

(R. 30.9.1931.)

" 43. No basket depending entirely for support on its handles shall be used for hoisting or lowering.

In hoisting a barrow, the wheel shall not be used as a means of support unless efficient steps are taken to prevent the axle from slipping through the bearing."

(R. 21.6.1926.)

IRISH FREE STATE

" 36. No load shall be left suspended from a crane unless there is a competent person actually in charge whilst the load is so suspended."

(R. 5.3.1930.)

(The other provisions concerning transport of goods in the Regulations of 5 March 1930 are identical with sections 25 and 43 above of the British Regulations.)

ITALY

" 10.

Further, the necessary measures shall be taken to protect the materials and tools conveyed in the hoist cage and to prevent them from falling."

(M.C. 9.9.1925.)

LUXEMBURG

" 25. Passage under suspended loads shall be restricted as far as possible."

(O. 28.8.1924.)

NETHERLANDS

" 34. Bricks and similar materials shall not be raised or transported more than 2.5 m. above the ground in barrows without fixed side-pieces or on open cages or platforms, unless adequate measures have been taken to prevent the materials from falling.

35. The hoisting of loads at points where there is a regular flow of traffic shall be carried out in an enclosed space. If this should be impossible, e.g. in the case of bulky objects, measures shall be taken to hold up or divert the traffic for the time being."

(R. 1934.)

POLAND

" 27. (1) The materials to be hoisted shall be so hung in the lifting hook that the point of suspension cannot be appreciably displaced and the suspended load cannot slip out of the hook.

(2) Containers for the transport of loose material shall be filled in such a way that the material cannot spill while being hoisted.

.

(6) It shall be prohibited to stand or pass under a hanging load.

.

35.

(5) When hot materials are being transported or hoisted the containers shall not be filled to the brim. The containers shall be provided with handles that protect the persons employed in transporting or hoisting them from the risk of burns."

(D. 23.5.1935.)

SWEDEN

" (p) In the transportation of heavy objects care shall be taken that the work is arranged and managed in a satisfactory manner and that the implements used for this purpose sufficiently ensure safety."

(A. 12.6.1931, sec. 4.)

SWITZERLAND

Geneva

" 122. The necessary steps shall be taken to ensure that barrows placed on hoist platforms cannot move while the hoist is in operation.

.

127. Throughout the operation of the appliances, and from the moment the load is moved, the chains and cables shall be vertical. In no circumstances shall the load swing.

128. No worker shall ever be below a load which is being moved. In no case shall the loads moved be over persons or any place to which the public has access."

(R. 25.3.1930.)

CZECHOSLOVAKIA

“ 50. (1) Building materials, tools and similar objects shall only be transported in buckets or carriers which prevent them from falling out. Conveyor buckets shall not be over-filled. The objects to be transported shall be placed in the hoist in a proper manner, so that no part of them projects beyond the floor of the hoist.

(2) Special care shall be taken in fastening beams, girders, planks or stones which are to be raised or lowered, in order to prevent their sliding out of the slings. Long objects shall be guided during conveyance by means of a special guide rope.

51. (1) Workers employed in raising and lowering loads shall take up positions such as to obviate any risk of accident to them in the event of the breaking of the rope or chain or any similar mishap. It shall not be lawful to pass or stand under suspended loads.

53.

(4) Workers shall not stand or pass under a load being transported by a crane, and a prohibition to this effect shall be displayed in a notice affixed at a suitable spot in the vicinity of the crane.”

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

Travelling Cranes (American Derricks, Wharf Cranes, etc.)

“ (g) The crane attendant shall supervise the loading of the crane.

(i) Kibbles with drop-bottoms, for the transport of concrete or other liquid materials, shall be so built that there is no risk of the bottom opening accidentally; the catches for opening and closing such kibbles shall be so made that there is no risk of the worker's hand being caught between the side of the kibble and the catch.

(j) Skips shall be used for transporting stones or other bulky objects on cranes. Special precautions shall be taken when transporting large stones that are difficult to fit into the skip; the stone or other bulky object shall be fastened under the supervision of the attendant, and no persons shall stand under the frath of the skip. Wedges of wood or other similar material shall be placed between the sharp edges of the stone or other object and the ropes.

(l) When skips from trucks (detachable from the frame) are being transported by crane to be loaded, their position shall be stable, so as to prevent them from tilting or upsetting.

(m) Workers engaged in loading skips transported by crane shall be acquainted with the general method of performing the work and with the maximum load of the crane.

(n) The dragging of loads by the hook of the crane or by turning the crane shall be prohibited, whatever the position of the load (on the ground, on rails, etc.)”

(O. 5.5.1930, sec. 136.)

Additional Rules for Travelling Wharf Cranes

“ (c) The utilisation of removable struts on cranes where these struts form part of the structure of the crane shall be compulsory for all work with loads closely approaching the maximum figure. The same provision shall apply to loads of any size when the crane is working for a long time at one spot.

(d) The supports for the removable struts shall be placed on both sides of the crane, forming a complete cage resting on level, rammed ground.

(g) When the load is being lifted, the hook of the crane shall be directly above it; in this connection it shall be borne in mind that when the jib takes the load the inclination of the jib increases as a result of the tension on the supporting ropes, and the load thus tends to swing away from the crane—a fact that increases the risk of upsetting.

(h) When the crane is working, sudden jerks in raising, lowering, slewing or stopping shall be avoided.

A sudden change of the crane mechanism from forward gear to reverse shall be prohibited, as this may damage the crane.

(i) When the maximum load is being lifted, it should first be raised a few centimetres from the ground; the stability of the crane should then be verified, after which the hoisting operation may proceed.”

(O. 5.5.1930, sec. 137.)

Hoists

“ 73. The necessary steps shall be taken to ensure that the cage can be loaded and unloaded without anyone having to enter it. Where this is done it shall not be necessary to provide devices for blocking the hoist.”

(O. 27.3.1931, sec. 73.)

YUGOSLAVIA

“ 127. When cylindrical objects, such as pipes, casks and the like are being transported, all the necessary measures shall be taken to prevent them from rolling while being raised.

133. (5) Materials transported by means of a hoist shall be arranged on the hoist so that they cannot fall therefrom. Receptacles containing mortar or water and other liquids must not overflow while being lifted.”

(R. 25.10.1921.)

(d) TRANSPORT OF PERSONS

GERMANY

“ 140. No person shall be conveyed by means of lifting appliances for materials only. This prohibition shall be posted up conspicuously.”

(R. 1.1.1930.)

AUSTRALIA

New South Wales

Steam Cranes and Steam Hoists

“ 18. No person shall ride upon the car or platform of any contractor's lift or hoist, unless the car of such lift or hoist is provided with an efficient safety gear, and the sides enclosed to a height of not less than 5 ft. 6 in. with gates or doors not less than 5 ft. 6 in. in height, or rails fitted 12 in. back from the edge, on the front and back.”

(A. 26.11.1912, Schedule, sec. 18.)

“ (g) Any person who is upon the platform of a builder's hoist while the platform is in motion shall be liable to a penalty not exceeding £20 and not less than 10s. unless the said platform is constructed in accordance with paragraph (j) of this Regulation.

(h) No person shall instruct, permit, or allow any other person to be upon the platform of a builder's hoist while the platform is in motion unless the said platform is constructed in accordance with paragraph (j) of this Regulation.

(i) A notice prohibiting all persons riding on the platform of a builder's hoist, shall be fixed and kept so fixed in such a position on the hoist platform that it can be clearly read by a person standing at least 3 ft. away from the

edge of the hoist platform. This provision shall not apply to hoist platforms constructed in accordance with paragraph (j) of this Regulation.

(j) A person may ride upon the platform of a builder's hoist if such platform is fitted with an efficient safety gear of a type approved by the Chief Inspector, and the platform sides not used for loading or unloading material are effectively enclosed to a height of not less than 5 ft. 6 in. above the platform flooring, and all loading or unloading sides of the platform are enclosed by gates or doors not less than 5 ft. 6 in. in height or rails fixed at a height of 3 ft. and fitted 12 in. back from the platform edge. The hoist platform shall be provided with a head cover or roof of sufficient strength to prevent falling objects striking any person on the platform."

(R. 17.9.1929, sec. 6.)

AUSTRIA

"18. The use of goods hoists for the raising or lowering of persons shall not be allowed. Such hoists shall only be used by persons where wells or chimney stacks are being built and only then if they are sufficiently safe."

(O. 7.2.1907.)

BELGIUM

"10. If hoisting appliances other than lifts specially intended for passenger traffic are used for the conveyance of persons, the total working load during such conveyance shall not exceed half the safe working load fixed for the carriage of goods; for this purpose the weight of each person shall be reckoned at 70 kilogrammes.

The lower, intermediate and upper landings of passenger lifts and of goods lifts used for passenger traffic shall be fitted with a locking device rendering it impossible to start the apparatus until all the doors are closed or to open any door until the cage comes to a standstill at the level of the corresponding landing.

The provisions of the two preceding paragraphs shall not apply to hoisting apparatus which cannot be used for the conveyance of persons other than the person in charge or persons whose duty it is to accompany the goods transported.

Nevertheless, in this case the necessary measures shall be taken to obviate any risk of the falling of such persons."

(R.O. 20.2.1933.)

CANADA

Alberta

"(83). No person shall be allowed to ride on hook or load."

(R. 1928.)

UNITED STATES

California

Construction Material Elevators

"(a) No employer shall allow or permit any person to ride in any elevator or hoisting apparatus provided for hoisting material unless such elevator or apparatus be constructed to comply with the requirements of Order 1115¹ following this order."

(G.O. 1.7.1926, Order 1114.)

Construction Material and Man Elevators

"(a) Whenever it is desired to permit persons to ride upon construction elevators, the provisions of this order and all sections of Order 1114¹ except sections (d) and (e) shall be complied with.

¹ See under § 1 (c) "Materials and Construction: Hoists".

(b) Such elevators shall be in charge of experienced operators.

(G.O. 1.7.1926, Order 1115.)

(a) No person shall be permitted to ride on loads or slings of any derrick or hoist, except as provided in Order 1115.¹

(G.O. 1.7.1926, Order 1137.)

Ohio

"Section 97. No employee shall ride nor be permitted to ride upon any material hoist or elevator unless such hoist or elevator conforms to the requirements for freight elevators as contained in the Specific Requirements relating to Passenger and Freight Elevators. Exception: Employees may be hoisted and lowered to and from their places of work on or in buildings or structures before and after the close of operations, on material hoists or elevators which do not meet the above requirements, provided the cages thereof are equipped with substantial overhead protection, guard-rails and side screens. Four (4) square feet of floor space shall be allowed for each passenger, but in no case shall the cage or equipment be so loaded that the factor of safety shall be less than four (4).

Section 98. On bridge or similar work of high elevation where it is necessary to transport or hoist employees in addition to materials continuously during the progress of the work, and where it is impracticable to construct and operate the hoists in conformity with the requirements for passenger and freight elevators, steel cables of sufficient size and strength to safely hold the cage in case the hoisting cable should break, in place of the regular guide rail equipment shall be provided, securely fastened at both top and bottom. The guideways of the cage shall be of substantial construction, securely enclosing the cable but permitting free operation. Such hoists shall be provided with an effective operating safety device. The cage shall conform to the requirements of sections 126 and 127² and shall be provided with substantial overhead protection, guard rails, side screens and toeboards. The cables shall be inspected and shall otherwise comply with the requirements of sections 28 and 29³ of this code. The hoisting equipment used on this type of lift shall be provided with an automatic stop.

Section 99. No employee shall ride nor be permitted to ride upon the load, sling, hook, ball or block of any derrick or crane, or the bucket of any hoist, except that men may be hoisted for the purpose of oiling overhead sheaves and making necessary repairs. This section shall not apply to stacks or caissons nor in the erection or dismantling of derricks, hoists and towers.

Section 100. Where it is known to be the safest method to reach places difficult and dangerous of access by other means, or where an extraordinary emergency exists, employees may be hoisted or conveyed to such places upon the hook of a crane or derrick."

(S.R. March 1931.)

Pennsylvania

"Rule 22. Hoists"

(h) A new installation of a freight elevator (in a new building) where the hatchways, enclosures and gates have not been completed may be used as a builder's hoist, provided the car is enclosed, the hatchway protected and the entrances guarded as required for builder's hoists erected on the inside of buildings. Such an elevator shall be in charge of an experienced operator, and may be used for carrying freight or building materials. Only the operator and assistants necessary for handling the load, who may not exceed three, are permitted to ride

(i)

¹ See above.

² See under § 2 (b) "Hoist Towers, etc."

³ See under Chap. 1, § 5 "Ropes and Chains"

A passenger elevator used as a builder's hoist may be properly tested and approved by an authorised inspector and a certificate issued as a builder's hoist before being put in service as a hoist.

Such an elevator shall be in charge of an experienced operator, and may be used for carrying passengers as well as building materials. Three (3) square feet of floor space shall be allowed for each passenger.

The number of persons permitted to ride at any one time shall be based on the ratio of one person to three square feet of floor area.

(n) No person shall be permitted to ride on the car of a hoist except under the following conditions:

1. The car frame shall be of all steel construction and shall be fitted with substantial car safeties located under the car platform which are capable of holding the car at any point of its travel.

2. The car safeties shall be actuated by a centrifugal speed governor and designed to bring the car to a gradual stop within a distance of eight (8) feet but not less than six (6) feet. The speed governor shall be set to operate before the speed of the car exceeds two hundred (200) feet per minute.

3. Spring bumpers shall be installed and shall be capable of reducing the velocity of the car at a maximum rate of 64.4 ft. per second, per second with a load of 150 lbs. descending at full speed.

4. Bumpers shall be located to strike the center sill or girder of the car.

5. The car enclosure shall comply with paragraphs (d) and (e) ¹ of this rule.

6. Guide rails for the cars may be of iron or steel. The lower ends of guide rails or guide posts shall be securely anchored or embedded to suitable footings and shall be securely fastened to the hoist structure at points not in excess of ten (10) feet apart and be reinforced by steel midway between such fastenings. Where guide rails are anchored at distances less than eight (8) feet apart, no other supporting is required. Guide rails, if of T shape shall have a uniform weight of not less than seven (7) pounds per lineal foot. If guide rails are tubular they shall have a uniform weight of five (5) lbs. per lineal foot and the car safeties shall be made to conform to the same shape as the guides and safeties made to grip at opposite sides of the guides."

(R. 1933.)

Wisconsin

"No employer shall permit anyone to be lifted by, carried by or to ride on, any hoist or derrick, with or without other load."

(G.O. 15.7.1933, Order 3531.)

FINLAND

"30.

The conveyance of persons by means of cranes shall be prohibited by means of a notice affixed on a board placed at the workplace in the vicinity of the crane.

31.

A hoist shall not be used for the conveyance of persons without the consent of the inspection authority."

(Res. 15.11.1927.)

FRANCE

"10. Except in the case provided for in section 12 ² and in the case of telpherage, for which special regulations will be issued, goods lifts and the kibbles of appliances for transporting material shall not be used for the conveyance of workers."

(D. 9.8.1925/26.11.1934.)

¹ See under § 1 (c) "Materials and Construction: Hoists: Cages and Hoisting Platforms"

² Concerns underground work.

GREAT BRITAIN

“ 24. No person employed shall be lifted or carried by a crane (except on the driver's platform) or ride in a barrow hoist, or in a hod hoist, or adopt other unsafe means of getting about the building, but every such person shall use the gangways, ladders or staircases or other safe means provided for the purpose.

Provided that it shall be permissible for a person to ride in a skip, bucket or other suitable receptacle which is fenced or of adequate depth so as to ensure safety, if suitable means are taken to prevent the spinning of the receptacle and if an efficient overwinding device is fitted to the hauling rope and an efficient system of signalling is used.”

(R. 30.9.1931.)

IRISH FREE STATE

“ 51. No person employed shall be lifted or carried by a crane (except on the driver's platform) or ride in a barrow hoist, or on a hod hoist, or adopt other unsafe means of getting about the building, but every such person shall use the gangways, ladders or staircases or other safe means provided for the purpose.”

(R. 5.3.1930.)

ITALY

“ 9.
These (lifting) appliances shall not be used for transporting persons unless they are fitted with a safety device.”

(M.C. 9.9.1925.)

LUXEMBURG

“ 23. Apparatus for lifting goods shall not be used for the transportation of passengers, except in well-sinking, where safety is sufficiently ensured. „

(O. 28.8.1924.)

MEXICO

“ 511. It shall be strictly forbidden for workers to use the appliances for hoisting materials as passenger lifts, except in cases where the hoists have been specially designed for this purpose and are therefore fitted with guard-rails of sufficient strength and safety devices for use in emergency.”

(R. 28.11.1934.)

SWITZERLAND

Geneva

“ 121. No person shall be conveyed in any building hoist whatsoever.”

(R. 25.3.1930.)

CZECHOSLOVAKIA

“ 48.

(2) It shall not be lawful to convey passengers in goods hoists, to lean into the hoist well or to enter the hoist if it is not secured in position in such a manner that it cannot descend even if the suspension rope should give way.

(3) The above prohibition shall be affixed in a clearly legible manner at every opening of the well for loading and unloading. If it is necessary for workers unloading materials from the hoist platform to stand thereon, the platform shall be fitted with a proper safety catch or shall be propped or braced to prevent it from hanging by the rope alone while work is being carried out on it.”

(O. 26.3.1931.)

URUGUAY

"IX. The lifting capacity shall be clearly indicated on all hoists, elevators, lifts, cranes and similar appliances. Such appliances shall not be used for conveying persons unless they are fitted with a safety device.

XIX. The use of goods hoists for transporting persons shall be strictly forbidden."

(R. 14.4.1915, secs. IX and XIX.)

YUGOSLAVIA

Hoists

"125. The hoists used for the transport of materials during building work shall not be used for the transport of persons. If they are thoroughly safe, their use for this purpose may be permitted as an exceptional measure during the construction of high chimneys or the digging of deep pits. . . ."

(R. 25.10.1921.)

(e) OVERLOADING; INDICATION OF MAXIMUM LOAD

GERMANY

"3. The maximum permissible load shall be indicated on all lifting appliances and they shall never be loaded beyond this maximum."

(R. 1.1.1930, sec. 138.)

Jib Cranes

"99. On cranes with fixed jibs the authorised maximum load shall be marked in a legible manner on the outside of the crane and inside the driver's stand.

100. On cranes with a movable jib an indicator shall be fitted on the driver's stand, giving the authorised load at every radius of the jib. This regulation shall not apply to cranes in which the adjustment of the jib is effected outside the driver's stand and while the crane is not under load.

102. On building cranes a table of weights for the counter-weights shall be available."

(R. 1.4.1934, Appendix, 2 (h).)

ARGENTINA

"75. Lifts, hoists and cranes . . . shall bear an indication of the maximum load that they can carry."

(D. 14.1.1916.)

AUSTRALIA

New South Wales

Hand Cranes

"14. The load of any hand crane, other than a test load, must not at any time exceed that which the crane is designed to lift.

Every hand crane shall have marked in a prominent position the maximum load which the crane is designed to lift.

Steam Cranes and Steam Hoists

16.

No load, at any time, excepting a *bona fide* test load, must exceed that which the crane is designed to lift.”

(A. 26.11.1912, Schedule.)

Builders' Hoists: General

“(c) The maximum safe load based on the factors of safety hereinbefore stated shall be painted in positions so as to be clearly discernible to the hoist driver, and to persons loading materials to be lifted or lowered by the hoist.”

(R. 17.9.1929, sec. 5.)

Queensland

“15 (4)

The crane or hoist shall bear a legible and permanent inscription naming the length of the jib, the maximum load, and the radius appropriate thereto. For cranes or hoists of variable radius clear indication of the permissible loads shall be given by means of an automatic radius indicator and a safe load indicator and (or) table.

When change speed gear is used on the lifting motion, the maximum load and speed for each lift shall be similarly indicated.”

(R. 24.12.1930.)

BELGIUM

“Lifting appliances . . . shall be marked with the maximum load which they can bear in the various positions of the suspension gear, and likewise, if they are used for the conveyance of employees, with the number of persons who can be carried simultaneously.”

(R.O. 20.2.1933, sec. 2.)

BULGARIA

“49. . . . The maximum load for the hoisting appliances shall be posted up at the entrances and exits of the shaft . . .”

(O. 4.5.1935.)

GREAT BRITAIN

“8. (a) Every crane shall have the safe working load, or, in the case of a crane fitted with a derricking jib, the safe working loads at various radii of the jib, plainly marked upon it.

(b) Every crab, winch and pulley block used in the hoisting or lowering of any load, and every derrick pole or mast used in the hoisting or lowering of any load weighing three tons or more, shall have the maximum safe working load plainly marked upon it.

9. (a) No crane whether having a fixed jib or a derricking jib shall be used unless it is fitted with an automatic indicator of a type approved in writing by the Chief Inspector of Factories, which shall indicate clearly to the driver or person operating the crane when the load being moved approaches the safe working load of the crane at any inclination of the jib and shall also give an efficient sound signal when the load being moved is in excess of the safe working load of the crane at any inclination of the jib. This requirement shall not apply:

- (i) Until 1 January 1933 in the case of a crane manufactured before 1 January 1902;
- (ii) Until 1 January 1934 in the case of a crane manufactured after 31 December 1901 and before 1 January 1912;
- (iii) Until 1 January 1935 in the case of a crane manufactured after 31 December 1911 and before 1 January 1922;
- (iv) Until 1 January 1936 in the case of a crane manufactured after 31 December 1921 and before 1 January 1932;
- (v) To any guy derrick crane;

(vi) To any hand crane which is being used solely for erecting or dismantling another crane; or

(vii) To a crane having a maximum safe working load of thirty hundred-weight or less;

provided that in all such cases a table showing the safe working loads at various radii of the jib shall be kept attached to the crane.

For the purposes of this Regulation "guy derrick crane" means a crane of which the mast is held upright solely by means of wire ropes with the necessary end fittings and tightening screws.

12. (a) A crane, crab, winch or any other hoisting appliance, or any part of such lifting gear shall not be loaded beyond the safe working load.

Provided that for the purposes of making tests of a crane or other hoisting appliance or gear the safe working load may be exceeded by such amount as the competent person appointed to carry out the tests may authorise.

(b) A crane shall not be used otherwise than for the direct lifting or lowering of a load unless its stability is not thereby endangered.

(c) The following precautions to prevent overloading or instability of any lifting appliance shall be taken in all cases where applicable:

(i) The weight shall be clearly marked on every single unit load of 3 tons and over. Provided that this shall not apply in the case of a crane fitted with an automatic indicator as specified in Regulation 9 (a).

(ii) No load which lies in the angle between the back stays of a Scotch derrick crane shall be moved by that crane.

(iii) Where more than one crane or winch is required to lift or lower one load, the machinery, plant and appliances used shall be so arranged and fixed that no such crane or winch shall at any time be loaded beyond its safe working load or rendered unstable in the hoisting or lowering of the load."

(R. 30.9.1931.)

IRISH FREE STATE

"35. Every crane, crab and winch . . . shall have the safe working load plainly marked upon it. If the safe working load of a crane may be varied by the raising or lowering of the jib or otherwise an automatic indicator of the safe working loads, or a table showing the safe working loads at the corresponding inclinations of the jib shall be attached to the crane. . . .

36. No crane or gear shall be loaded beyond the safe load . . ."

(R. 5.3.1930.)

ITALY

"9. The lifting capacity shall be clearly indicated on hoists, winches, lifts, elevators, cranes and similar mechanical appliances."

(M.C. 9.9.1925.)

POLAND

"24. (1) On every hoisting appliance the maximum safe load shall be marked in a conspicuous place . . .

(4) It shall be prohibited to load hoisting appliances, hoists and cranes beyond the safe maximum."

(D. 23.5.1935.)

SWEDEN

"(b) Hoists, cranes, overhead railways and other similar transportation apparatus shall be inspected and tested in such manner as may be deemed

adequate; the maximum load for which they were approved on the occasion of the last inspection, together with the date of such inspection, and, if the apparatus is intended for passenger traffic, the number of persons that can safely make use of it at a time, shall be clearly marked thereon in a suitable place."

(A. 12.6.1931, sec. 4.)

SWITZERLAND

Geneva

"118. At the request of the competent departments, lifting appliances shall be subjected to a load test. The maximum safe load provided for by the maker shall be clearly indicated on such appliances."

(R. 25.3.1930.)

CZECHOSLOVAKIA

"(2) The safe working load in kilogrammes shall be marked plainly and durably on all lifts and hoisting apparatus (cranes)"

(O.26.3.1931, sec. 46.)

UNION OF SOVIET SOCIALIST REPUBLICS

Additional Rules for Travelling Wharf Cranes

"(a)
Every crane shall bear a plate showing the maximum load permitted for different lengths of the jib, whether removable struts are used or not. This table of loads shall take account of the slightly inclined position of the crane when working at a curve in the track or when one of the rails is higher than the other.

(b) The crane crew shall be supplied with means of determining the length of the jib for each load, the weight of which shall also be known. A measuring dial ("roulette") may be used. The use of permanent automatic devices for determining the length of the jib shall be permissible only with the approval of the local factory inspector."

(O. 5.5.1930, sec. 137.)

Hoists

"76. At all loading and unloading places notices shall be posted indicating the maximum permissible load for hoisting and lowering."

(O. 27.3.1931.)

URUGUAY

"IX. The lifting capacity shall be clearly indicated on all hoists, elevators, lifts, cranes and similar appliances."

(D. 14.4.1915, sec. IX.)

YUGOSLAVIA

"125. . . . The maximum load in kilogrammes shall be marked on every hoist . . ."

(R. 25.10.1921.)

(f) RULES FOR DRIVERS AND OTHER WORKERS

GERMANY

Power-driven Cranes: Crane Attendance and Working

"34. Cranes shall only be operated by reliable persons who are familiar with the mechanical and electrical equipment and are aware of the accident

risks. Cranes with a driver's stand shall only be operated by persons over 18 years of age. The driver shall be acquainted with the type and pressure of the current, and with the means of switching off the power mains and the wiring on the crane.

35. The driver shall be responsible for the maintenance of the crane in accordance with the operating instructions he has received. He shall inspect all parts subject to wear and report any cases of undue deterioration. He shall in particular report immediately any damage to ropes, any cases of the rope slipping from the drum or engaging in the gears, and the formation of any knots or loops; and if there is any danger in delay, he shall stop the crane.

36. Ropes which have slipped from the drum or engaged in the gear, or in which knots or loops have been formed, shall be thoroughly tested before further use.

37. The driver shall test all the brakes once a day to see that they are in good working order. In the case of cranes which are seldom used, he shall test the brakes before every occasion on which the crane is used. When brake blocks are worn, he shall ask in good time for their replacement. If the brakes fail he shall immediately stop the crane.

38. The driver shall see that the drive and running wheels are properly greased. Bearings and drive shall only be greased or cleaned while the crane is not in operation, during interruptions in work and special pauses for greasing. Moving parts shall only be greased if special devices for this purpose are used which allow the operation to be carried out safely.

39. (1) The driver shall not leave the stand so long as there is a load on the hook.

(2) In the case of cranes operated in the open air, when the crane has stopped, he shall block it with the devices provided to prevent its moving in the wind.

40. Only the driver or other specially authorised persons who are aware of the accident risks shall have access to crane installations.

41. (1) When he is relieved, the driver shall hand over the crane to his relief and point out any irregularities. He shall also report any such irregularities immediately.

(2) He shall immediately inform his superior if his relief fails to arrive.

42. Before the main switch on the driver's stand is switched on, care shall be taken to see that all the controllers are set at zero.

43. In operating the controllers, allowance shall be made for slowing down so as to ensure that lifting and travelling stop without any shock.¹

44. (1) The current shall be switched off before the driver leaves the cab, in the event of any damage to mechanical or electrical parts, and before beginning any repairing or maintenance work. The controllers shall first be set at zero and then the main switch turned off. It shall not suffice to set the controllers at zero since many controllers do not switch off in all phases.

(2) In the event of any irregularity occurring in the operation of the crane while the load is being hoisted, the controllers for the lifting mechanism shall immediately be set at zero. If the load continues to descend, the main switch shall be pulled over so as to apply the brake.

45. Switches, even if automatic, shall not be wedged or blocked.

46. Electrical equipment shall not be used for heating. Only the heating equipment installed shall be used for this purpose.

47. Cranes shall not be used to wrench off loads which are held fast (but see section 88).²

¹ If the crane is allowed to knock against the buffers or a neighbouring crane, the driving parts may break, while if the pulley block is allowed to rise too high the rope may break and the load fall. Limit switches are emergency switches. They are only designed for emergency working.

² Concerns cranes specially built for wrenching off loads.

48. (1) When the crane is travelling, the driver shall watch the load. If necessary, a warning shall be given before every movement.

(2) So far as this can be avoided, loads shall not be hoisted over persons. Persons shall not be hoisted with the load.

49. (1) The crane shall not be loaded beyond the indicated maximum load.

(2) The pulley block shall not be lowered beyond the point at which $1\frac{1}{2}$ turns of rope are left on the drum.

50. The regulations in regard to the "Crane Attendance and Working" (sections 34 to 49) shall be posted up at the driver's stand."

[Travelling cranes (51 to 95); Floor-controlled cranes (96); Cranes with traversing jib crabs (97).]

(R. 1.4.1934, Appendix. 2 (h).)

AUSTRIA

(For general rules applying to all building operations see under Chap. I, § 8 (d), "Rules for the Workers".)

"47.

(6) Persons shall not be allowed to remain under scaffold openings for goods hoists while the hoist is working. While such hoist is not working the shaft shall be completely closed.

(7) In the operation of lifting appliances the load shall be carefully and securely fastened, or so placed that the material hoisted cannot fall out.

Carriers shall not be so filled that if they rock the material hoisted can fall out or overflow.

(8) Mortar shall be so poured into the tubs and containers that splashing is as far as possible avoided.

(9) In the lowering of loads by cranes or winches the brake shall not be released until the crank handle has been removed, or where this is not possible, until the workers have stepped aside.

The grasping of moving crank handles shall not be allowed.

When loads are being hoisted the pawl shall always be on the ratchet wheel."

(O. 7.2.1907.)

UNITED STATES

California

"Order 1117. *Duties of Hoisting Engineer.* The following orders shall be observed by every hoisting engineer employed on construction work within this State:

(a) It shall be the duty of every hoisting engineer to keep a careful watch over his engine and/or hoisting machine under his charge.

(b) He shall familiarize himself with and use all signal codes for hoisting and lowering as directed to be used in these orders.

(c) He shall not run his engine and/or hoisting machine unless the same is properly provided with efficient brakes and indicators or distance marks on hoisting ropes or cables.

(d) It shall be the duty of the hoisting engineer to exclude every person from his engine room or station of duty excepting any person or persons whose duties require their presence therein.

(e) He shall have no conversation with anyone while his engine and/or hoisting machine is in motion or while attending to signals.

(f) He shall run his engine and/or hoisting machine with extreme caution whenever men are being hoisted or lowered.

(g) He shall not operate any hoist at a speed greater than the rate posted at his place of duty.

(h) He shall make daily inspections of all hoisting machinery and safety appliances connected therewith and report any defects therein to the respon-

sible person in charge of the work, and shall not use said machinery until satisfied that all defects have been remedied.

(i) He shall familiarize himself with and carry out the requirements of all orders pertaining to the proper discharge of his duties.

(j) The superintendent, foreman or the responsible person in charge of operations on any construction job coming within these orders shall post a copy of the hoisting engineer's orders in a conspicuous place at his place of duty.

(k) Hoisting engineers shall not permit anyone to oil the engine or machine while it is in motion and shall exercise every care for the safety of employees around engines."

(G.O. 1.7.1926.)

LUXEMBURG

" 51. Workers shall not use a goods lift or hoist for ascending or descending. Nevertheless, this provision shall not apply to well sinkers.

No one shall remain under a goods lift or hoist, loads in mid-air or scaffolding which is being taken down.

Stones for building and tools shall be transported in carriers and not merely in slings. The carriers shall not be overloaded.

52. In raising up the load, the pawl shall always lie in gear in the ratchet wheel; the sudden stoppage of cranks in motion shall be prohibited. The brake shall not be applied until the crank has been removed and the workers have moved away."

(O. 28.8.1924.)

CZECHOSLOVAKIA

[For general rules applying to all building operations, see under Chap. I, § 8 (d) " Rules for the Workers."]

" 87. (1) When a hoist is being used, the load shall be carefully and securely fastened, or stowed so that its components cannot fall off.

(2) Persons shall not work or remain under suspended loads, under girders while they are being moved, under the roof truss while it is being erected, etc..

(3) Passengers shall not be carried in a hoist which is not equipped for the conveyance of passengers. Persons shall not slide down ropes or let themselves down by a pulley.

(4) Conveyor buckets shall not be filled so full that the rocking of the bucket is likely to cause the contents to fall out or overflow.

(5) Mortar shall be poured into tubs and receptacles in such a manner as to obviate splashing as far as possible.

(6) The load placed on a wheelbarrow shall not exceed that which a worker can control when handling the barrow properly.

(7) Workers shall not carry loads jointly, except under the supervision and direction of a charge hand; it shall first be ascertained that the way is clear.

88.

(4) When a load is being lowered with a crane and winch, the brake shall be applied evenly and cautiously, and shall not be released until the cranks have been taken off, or, if this is not possible, until the workers have moved out of the way.

(5) Workers shall not seize the moving crank handles of hoists, cranes and windlasses.

(6) When a load is being raised, the pawl shall be permanently in action.

(7) The safe working load marked on hoisting apparatus shall not be exceeded."

(O. 26.3.1931.)

YUGOSLAVIA

"133. *Rules for workers.* The following rules shall be binding on workers employed in building, and shall be affixed conspicuously as such at every building workplace, where possible:

(5) Materials transported by means of a hoist shall be arranged on the hoist so that they cannot fall therefrom. Receptacles containing mortar or water and other liquids must not overflow while being lifted.

(9) Building installations shall not be used for any other purpose than that for which they are intended.

(10) Workers not employed at the building workplace shall not meddle with cranes, windlasses, machines, electrical conductors, or other dangerous installations there situated."

(R. 25.10.1921.)

(g) MISCELLANEOUS RULES

GERMANY

Jib Cranes

"114

(2) When there is a storm, the crane shall be stopped and, whenever possible, at a place on the runway where it will be protected from the storm."

(R. 1.4.1934, Appendix, 2 (h).)

BULGARIA

"48. . . . No worker shall be in the shaft while materials are being hoisted or lowered . . . workers employed on the top platform shall be provided with belts and shall be roped."

(O. 4.5.1935.)

UNITED STATES

Ohio

"Section 95. No employee shall work in or shall be permitted to work in elevator or hoist shafts when the elevators or hoists are in operation, except when the elevator platform or top is used as a scaffold, or when making repairs or while loading or unloading.

Section 96. No material, tools, or other objects shall be hoisted or lowered in elevator or hoist shafts when employees are working therein except such tools, materials and equipment as may be necessary for their work.

Section 109. Substantial overhead protective covering shall be provided in elevator or hoist shafts when employees are working therein.

Section 111. The use of ladders in elevator or hoist shafts by other than employees engaged in the erection, construction or repair of shaftways or equipment thereof after the elevator or hoist has been put in operation, is prohibited."

(S.R. March 1931.)

Pennsylvania

"(j) Builder's hoists shall not be operated to carry materials or passengers when men are working in or around a hatchway.

(m) The operation of more than one hoist by the same hoisting machine is prohibited."

(R. 1933, Rule 22.)

NETHERLANDS

“ 33. If a hoisting appliance or any part thereof moves along a scaffold, adequate measures shall be taken to prevent persons on the scaffold from being struck by the appliance or any part of it.”

(R. 1934.)

POLAND

“ 27.

(5) All dangerous places within the range of hand-operated or automatic hoisting appliances shall be enclosed. Only the persons in charge of them shall be allowed access to them. The present requirement shall be brought to the notice of all concerned by means of a warning posted up in a conspicuous place.”

(D. 23.5.1935.)

CZECHOSLOVAKIA

“ (5) During storms and every interruption of work the supply of current to the crane motors shall be cut off.”

(O. 26.3.1931, sec. 53.)

UNION OF SOVIET SOCIALIST REPUBLICS

Travelling Cranes (American Derricks, Wharf Cranes, etc.)

“ (d) On large building sites, one person shall be specially appointed to exercise general supervision over cranes and their working; the same person shall instruct crane drivers.

(e) No strangers shall be admitted to the cranes.”

(O. 5.5.1930, sec. 136.)

Additional Rules for Travelling Wharf Cranes

“ (k) When cranes pass or are working near electric cables the jibs shall be lowered as far as may be necessary. When this cannot be done, a temporary buffer shall be placed on the track between the crane and the electric cables so as to prevent the crane from passing below them with the jib raised.

The space between the electric cables and the highest point of a crane passing underneath them shall not be less than 3 m.”

(O. 5.5.1930, sec. 137.)

Hoists

“ 65. The gates may be made entirely of wood without automatic locking devices. The management shall, however, see that during working hours attendants are on duty at the gates used for loading or unloading materials. These attendants shall be responsible for opening and closing the gates and giving the necessary signals (by means of a signalling system devised for the purpose) when the hoist is set in motion at the loading or unloading point, and for seeing that the maximum load fixed for the hoist is not exceeded.

When work stops and when the hoist attendants are absent the shaft gates shall be padlocked. The gates at landings where no work is done shall also be padlocked.”

(O. 27.3.1931.)

§ 6. — Maintenance; Inspection and Testing by the Builder or his Representatives

[For special regulations concerning the testing of ropes and chains, see under § 3 “Ropes and Chains”.]

GERMANY

“ 138

4. All parts of every lifting appliance shall be thoroughly tested as to their carrying capacity at suitable intervals, but at least once a year. The ropes, chains and framework intended for lifting and carrying loads shall be inspected frequently.

145. Carrying equipment shall be prevented from moving during cleaning or repairs.”

(R. 1.1.1930).

Hand-driven Cranes

“ 20. Before use new cranes shall be tested both at rest and in motion with a load 25 per cent. more than the maximum load indicated on the crane.

Jib Cranes

118. (1) New cranes with fixed jibs shall, before being taken into use, be subjected at rest and in operation to a test load 25 per cent. above the maximum load indicated on the crane.

(2) New cranes with movable jibs shall, before being taken into use, be subjected at rest and in operation, at various inclinations of the jib, to a test load 25 per cent. above the load authorised under section 100.¹

(3) While the test load is applied, all movements (travelling, slewing and braking of the crane, raising, lowering and braking of the load) shall be carried out with the caution required in normal operation; the movements shall be made slowly and without jolting. The test shall be undertaken on a horizontal track with a superstructure of adequate bearing capacity.

(4) If the strength of the structural parts so allows, the test for stability may also be carried out by suspending a stationary test load 50 per cent. above the authorised load. In the case of cranes running on tracks, and tower slewing cranes for building and underground construction, this test shall be carried out with a load not more than $33\frac{1}{3}$ per cent. above the authorised load for a horizontal track.

(5) In the case of floating cranes a tilting test shall be undertaken.

119. Cranes and their load carrying parts as well as the appliances used to secure stability shall, when necessary, but at least once a year, be thoroughly examined in all their parts and, if necessary, repaired.

120. The results of the test on delivery and the periodic tests shall be entered in a test register. To the test register shall be annexed a certificate of stability, furnished by the manufacturer and containing the relevant calculations.”

(R. 1.4. 1934, Appendix, 2 (h).)

AUSTRALIA

New South Wales

“ (c) All moving parts of every hoist winch shall be kept lubricated. Lubricators shall be so arranged that it will be unnecessary to remove any guard or other winch part for lubrication purposes.

(k) All gearing shall be kept in safe, satisfactory and good condition.

Keys in gear trains shall be locked so that they cannot work adrift.

Forthwith upon the breaking of a tooth in a wheel or pinion the wheel or pinion shall be discarded and replaced. Wheels with cracked arms, rims, or bosses shall also be forthwith discarded and replaced.”

(R. 17.9.1929, sec. 4.)

¹ See under § 5 (e) “ Overloading: Indication of Maximum Load ”.

Queensland

Testing

“ (29) Before being put into service the crane shall have each motion tested under the following conditions :

- (a) When the hook is carrying the maximum rated load and is working at the maximum radius;
- (b) When the hook is unloaded;
- (c) When the hook is carrying an overload of at least 25 per cent. in excess of the maximum rated load under the conditions defined in (a).

During the tests (a) and (b) the speeds enumerated in Crane Data Sheet shall be substantially as specified. The maximum and minimum radius, and the slewing motion shall be tested in both directions through the maximum angle for which the crane or hoist is designed to slew.

During test (c) the specified speeds need not be attained, but the crane or hoist shall show itself capable of dealing with the overload without difficulty.

A certified record of the test figures shall be supplied to the purchaser.

The tests shall be carried out under the supervision of an Inspector of Machinery at a place to be agreed upon between the purchaser, the manufacturer, and the inspector, and when conducting acceptance tests the manufacturer shall be entitled to employ his own crane or hoist driver.

The requirement that the contract speeds of electric cranes or hoists are to be attained is contingent on the electric supply to the motors being correctly maintained.”

(R. 24.12.1930.)

BELGIUM

“ 13. The various parts of hoisting appliances shall be maintained in perfect condition

14. Before being taken into use every hoisting appliance intended for passenger traffic or for travelling or for moving loads above places where there may be persons shall be thoroughly examined by a competent inspector.

This person, whom the head of the undertaking shall select and for whom he shall be responsible, shall satisfy himself that all parts of the appliance are sufficiently strong, that there are no defects, that the operation of the appliance and its accessories does not give rise to any danger, and that all the provisions laid down in the regulations relating to the safety of the appliance are complied with. He shall satisfy himself that no excessive or permanent deformation occurs even when the appliance is working under the most unfavourable conditions.

In the case of travelling cranes the inspection shall include the runway.

The said inspections shall be carried out exclusively by persons whose character and fitness to recognise defects in hoisting appliances and their various parts and accessories and to understand the consequences thereof are adequately guaranteed.

The head of the undertaking shall inform the competent technical official of the names of the persons whom he has selected as inspectors.

Appliances covered by this section which are installed after the coming into operation of this Order shall not be taken into use until the inspector has issued a certificate respecting this previous inspection and stating that the appliance can be safely operated.

The owner shall submit this certificate to the technical official responsible for supervision whenever he so requests.

15. Hoisting appliances shall be subjected at least once every twelve months to a thorough and complete inspection, covering in particular the framework, machinery and various accessories and also the runway (if any).

Moreover, the cables, chains, hooks, levers, sheaves, cross-beams, brakes, limit switches and any other parts of direct importance from the point of view of safety shall be inspected at least once every three months.

The inspections provided for in the two preceding sections shall be carried out by persons chosen by the head of the undertaking (who shall be responsible for them), in conformity with the conditions laid down in the preceding section.

The head of the undertaking shall inform the competent technical official of the names of the persons whom he has selected as inspectors.

If they consider it advisable, the inspectors shall cause cables and chains to be tested before being taken into use and while in use.

They shall order the annealing of any parts the metal of which may have deteriorated, particularly where this occurs in consequence of the pressure or character of the work done.

After each inspection the inspector shall draw up a report in which he shall mention in detail the defects observed and specify the measures to be taken to remedy them. This report shall be forwarded without delay to the owner of the appliance, who shall submit it to the technical official responsible for supervision whenever the latter so requests.

If it is ascertained that the inspector is negligent in the performance of his duties, or if it is proved that the certificates drawn up by him do not show the true state of affairs, or if there is reason to doubt his ability, the chief inspector of mines, the chief district labour inspector or the head of the Explosives Department, each in so far as he is concerned, shall be entitled to object to the inspector and call upon the head of the undertaking to choose another who complies in full with the requirements.

16. Every part held to be defective or doubtful as to strength shall be taken down and removed so that it cannot be used again.

A record of parts replaced and the reasons for such replacement shall be kept in a register specially intended for this purpose. This register shall be kept at the disposal of the competent technical official."

(R.O. 20.2.1933.)

CANADA

Alberta

"(81) Cranes and derricks shall be inspected every day and kept in perfect working order. All working parts shall be oiled daily. Cables shall be kept well oiled.

.....
(84) When repairing cranes, it shall be located where the repair work will least interfere with the other cranes and with operator on the floor.

(85) Before starting repairs, the repairman shall see that all controllers are thrown 'off' position, that main or emergency switches are open, and one of them shall be locked.

(86) Where a crane is to be repaired, there shall immediately be placed warning signs or out-of-door signs on crane and on floor beneath. If other cranes are operated on the same runway, safety-stops shall be placed at safe distance.

(87) Workmen shall not work on floor beneath crane while it is being repaired. Crane shall not be operated after repaired until all safety devices are installed and loose material removed."

(R. 1928.)

UNITED STATES

California

Inspection of Hoists

"Section 3. It shall be the duty of the industrial accident commission to inspect all hoists coming within the definition contained in section 1¹ of the

¹ Not reproduced.

act herein amended. If any part of the construction or system of signals used on a hoist is defective or may endanger the lives of the men working in immediate vicinity of said hoist, the industrial accident commission shall direct the person in charge thereof to remedy such defect, and such hoist shall not be used again until the order of the commission shall have been complied with."

(Ch. 275, Statutes 1913 as amended by
Ch. 332, Statutes 1921.)

Wisconsin

See under Chap. 1. § 3 (c) " Inspection of Scaffolds, etc., by the Builder or his Representatives."

FINLAND

" 30.

Lifting apparatus shall be duly inspected before it is first used at the work-place. The inspection shall be repeated every time the lifting apparatus undergoes considerable alteration or in course of removal from place to place suffers damage prejudicial to its safe use."

(Res. 15.11.1927.)

FRANCE

" 2. The material used in the workplaces for . . . appliances for hoisting . . . shall be tested before use . . .

3. Appliances for hoisting or handling, before being made available for use in the workplace, shall be examined in all their parts by the employer or his deputy, and tested with a view to ensuring their solidity.

Whenever any such appliance has been taken down or modified, or any of its parts has been replaced, the test shall be repeated. A new test shall also take place when workers point out defects in the appliances, or the presence of causes liable to affect their solidity."

(D. 9.8.1925/26.11.1934.)

GREAT BRITAIN

" (5)

(j) The whole of the appliances for the anchorage of a crane shall be examined on each occasion before erection, and the erection shall be supervised by a competent person.

(k) (i) Each crane shall after erection on a building site and before use be tested *in situ* for anchorage, by a competent person, by the imposition on each anchorage of the maximum uplift or pull exerted either by a load of 25 per cent. above the maximum load to be lifted on the site by that crane or by a less load arranged to exert an equivalent pull on the anchorage, and an entry of the prescribed particulars of the test shall be made forthwith in the prescribed Register, and (ii) after each re-erection of the crane and before it is again used on the same building site the anchorages of the crane shall be examined by the person responsible for the re-erection.

If the maximum load which the person making such test or examination considers may safely be lifted by that crane as anchored is less than the safe working load of the crane, a loading diagram appropriate to the crane anchorage must be affixed in a position where it can readily be seen by the crane driver.

6. No travelling jib crane shall be used unless it has been tested and examined by a competent person and a certificate of such test and examination in the prescribed form specifying the safe working loads at various radii of the jib, including the maximum radius at which the jib can be worked, has been obtained from the person who made the test and examination. The safe working load so specified at any radius shall be not more than eighty per

cent. of the maximum load which the crane has stood at that radius during the application of the test.

7. No jib crane shall be used after alteration or substantial repair to any part involving the strength of the part or stability of the crane, unless it has since such alteration or repair been tested and examined by a competent person and a certificate of such test and examination in the prescribed form specifying the safe working load (or, in the case of a crane fitted with a derricking jib, the safe working loads at various radii of the jib, including the maximum radius at which the jib can be worked) has been obtained from the person who made the test and examination. The safe working load so specified at any radius shall be not more than eighty per cent. of the maximum load which the crane has stood at that radius during the application of the test."

(R. 30.9.1931.)

IRISH FREE STATE

" 34. The working gear and anchoring appliances of every crane, crab or winch and other hoisting apparatus shall be kept in good repair and in good working order, and shall, as far as practicable, be examined in position at least once in every week by a competent person. The results of this examination shall be entered forthwith in the prescribed register."

(R. 5.3.1930.)

POLAND

" 25.

(6) Hoisting appliances shall not be cleaned or greased while in motion.

26. Hoisting appliances used in building operations shall be under the constant supervision of competent persons. Every two weeks the working and wear of the different parts of the appliance shall be verified. Defective parts shall be repaired or replaced."

(D. 23.5.1935.)

SWEDEN

" 4. (b) . . . Hoists, cranes, overhead railways and other similar transportation apparatus shall be inspected and tested in such a manner as may be deemed adequate."

(A. 12.6.1931.)

SWITZERLAND

Geneva

" 129. Before they are taken into use, appliances for lifting or handling materials shall be inspected by the contractor in all their parts and tested.

The inspection and tests shall be repeated whenever the appliances have been taken to pieces or altered or when one of the parts has been replaced. The inspection and tests shall also be repeated whenever any worker reports defects in the appliances or the existence of circumstances likely to impair their solidity.

.

133. Winches, screw-jacks, rack jacks, chains, pulley blocks and cables which are in use shall be inspected at least once a year by specialists. All parts shall be kept clean and shall be lubricated to the extent necessary for their protection and preservation."

(R. 25.3.1930.)

CZECHOSLOVAKIA

Lifts and Hoists

" 46.

(2) The safe working load in kilogrammes shall be marked plainly and durably on all lifts and hoisting apparatus (cranes). All lifts shall be tested

before being used for the first time on a building. Goods platform hoists, motor-driven hoisting apparatus and cranes shall be tested in accordance with the regulations in force at suitable intervals, and in any case at least once every six months. A record of the tests shall be kept at the constructional workplace, and shall be submitted on request to the supervising official of the labour inspectorate.

(3) Before hoisting apparatus is taken into use, the persons responsible for driving and supervising it (who must have a good knowledge of its construction) shall ascertain that all component parts, and in particular the movable parts such as chains, cables, hooks, pawls, brakes, toothed gear, cranks and the like, are in good condition. Any defects observed shall be remedied forthwith.

Cranes and Winches

53. (3) . . . the crane shall be properly tested before being anchored.”

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

Travelling Cranes (American Derricks, Wharf Cranes, etc.)

“(c) New cranes shall, before being used, be examined by the technical inspector of the People's Commissariat for Labour. Periodical inspections of cranes shall also be carried out by the technical staff on the building site at the following intervals: (1) a detailed examination of the mechanism once a month; (2) tensile tests for ropes and chains at least once in every six months; (3) a surface examination of all ropes, chains and suspension gear every week.

The examination of cranes on delivery by the technical inspector, and subsequently by the technical staff on the building site shall be carried out in accordance with the General Regulations of the People's Commissariat of the U.S.S.R. concerning hoisting appliances.

When a driver comes off duty he shall make certain, before anyone else takes over, that the brakes and all the controls of the crane are in good working order; he shall report any defect noted to the member of the technical staff responsible for the supervision of cranes and to the new crane crew.”

(O. 5.5.1930, sec. 136.)

Additional Rules for Travelling Wharf Cranes

“(a) Before being brought into use, these cranes shall be tested from the point of view of stability by the management of the workplace, independently of the preliminary tests to which they are submitted by the technical inspector of the People's Commissariat for Labour . . .”

(O. 5.5.1930, sec. 137.)

Hoists

“67. A safe means of access shall be provided for greasing and inspecting the machine parts at the top of the hoist shaft.

78. The strength of the cables, the solidity of their anchorage and the solidity of the hoist mechanism shall be subjected to a ten minutes' test, during which the cage shall be blocked in its lowest position. The static test shall be carried out with a load double the maximum load and the dynamic test with a load exceeding the maximum load by 10 per cent. (see sections 52-54¹).”

(O. 27.3.1931.)

¹ Not reproduced.

§ 7. — Miscellaneous

(a) SCOPE OF REGULATIONS

GERMANY

Hoists, Cranes and Other Lifting Appliances

“For the purpose of the present regulations ‘hoist’ (*Aufzug*) means lifting plant (*Aufzugsanlagen*) with a travel exceeding 2 m., the carrying equipment of which moves between guides and does not leave them.

The regulations shall not apply to building hoists worked by hand and small goods lifts worked by hand and carrying not more than 20 kg. These and all other lifting plant shall be deemed to be lifting appliances (*Hebezeuge*).

137. The provisions of the Lift Regulations, together with the rules for their enforcement and the technical principles laid down by the German Lifts Committee, shall apply to all hoists.”

(R. 1.1.1930.)

Jib Cranes

“98. Sections 99-120 shall apply to such power-driven cranes, including floating cranes, in which there is a possibility of overturning in consequence of overloading, jolting in working—for example in starting up, stopping and slewing the crane, through unevenness of the track, or in lifting and lowering or braking the load or wind pressure.”

(R. 1.4.1934, Appendix, 2 (h).)

BELGIUM

“1. Hoisting apparatus, i.e. travelling cranes, other cranes, goods lifts, passenger lifts, escalators and overhead railways used in industrial and commercial undertakings subject to the Act of 24 December 1903, respecting compensation for injuries resulting from industrial accidents, shall be subject to the provisions of these Regulations if they are driven by a steam engine or a motor subject to the regulations for establishments scheduled as dangerous, unhealthy or obnoxious.

Further, in dependencies and plant in mines, open workings and quarries other than shafts and underground workings and in industrial and commercial undertakings which are explicitly included in the schedule of dangerous, unhealthy or obnoxious establishments, these Regulations shall also apply to the appliances specified in the preceding paragraph in cases where they are operated by hand or by a motor other than the motors covered by the said paragraph, subject to the restriction that appliances operated by hand shall not be subject to these Regulations in cases where the weight of the load to be lifted or handled does not exceed 1,000 kilogrammes.”

(R.O. 20.2.1933.)

GREAT BRITAIN

The Regulations apply “to all premises on which machinery worked by steam, water or other mechanical power is temporarily used for the purpose of the construction of a building, for the purpose of any addition to the structure of an existing building. Provided that nothing in these Regulations shall apply to premises on which the only machinery worked by steam, water or other mechanical power consists:

- (a) Of machinery which is not used for hoisting purposes and is outside the area of the building under construction, or
- (b) Of portable tools such as drills or rivetters.

Provided also that if the Chief Inspector of Factories is satisfied in respect of any crane or other hoisting appliance or plant that, owing to the special

conditions of work or otherwise, any of the requirements of the Regulations can be suspended or relaxed without danger to the persons employed, he may by certificate in writing authorise such suspension or relaxation for such period and under such conditions as he may think fit. Any such certificate may be revoked by the Chief Inspector at any time."

(R. 30.9.1931, Preamble.)

NEW ZEALAND

" 3. (1) Nothing in this Act shall apply to:

- (a) Any machinery driven by manual or animal power; or
- (b) Any machinery the motive power of which does not exceed one horse-power; or
- (c) Any boiler or machinery which is declared by the Governor-General by Order in Council in that behalf not to be subject to the provisions of this Act."

(A. 2.10.1928.)

UNION OF SOVIET SOCIALIST REPUBLICS

Hoists

" 63. The general regulations concerning elevators (Parts II-VIII ¹) apply, subject to the exceptions and additions contained in the present part, to hoists for building materials erected for work of not more than one year's duration."

(O. 27.3.1931.)

(b) FORMALITIES FOR ERECTION AND USE

GERMANY

"138. (1.) Cranes for which official approval is required shall only be used when they have been tested and authorised as suitable for the work in question. The official authorisation and the working rules shall be posted up at the work-place.

(2.) According to the use for which they are intended, cranes shall be so constructed, erected and operated as to ensure their stability. On request, the Executive of the Association shall be supplied with static calculations concerning the erection of the crane."

(R. 1.1.1930.)

AUSTRALIA

New South Wales

"Twenty-four hours' notice of intention to set up or build any scaffolding engine or steam crane must be served on an inspector except in cases of emergency."

(A. 26.11.1912, sec. 6.)

Queensland

Cranes and Hoists

"All necessary data regarding the conditions under which the crane or hoist is to be used must be supplied to the Chief Inspector. Plans and specifications must be submitted to the Chief Inspector for his approval before erection."

(R. 24.12.1930, sec. 2.)

¹ Not reproduced.

UNITED STATES

Pennsylvania

“ (h)

A freight elevator used as a builder's hoist shall be properly tested and approved by an authorized inspector and a certificate issued as a builder's hoist before being put in service as a hoist.

.

(i) A passenger elevator used as a builder's hoist may be properly tested and approved by an authorized inspector and a certificate issued as a builder's hoist before being put in service as a hoist.”

(R. 1933, Rule 22.)

NEW ZEALAND

“ Every person who becomes the owner of any machinery subject to the regulations must notify the district inspector within one month.”

(A. 2.10.1928, sec. 11.)

POLAND

“ 2.

(2) When use is made during building operations of auxiliary installations of complex construction that are intended to bear considerable loads, at the request of the competent building authority the plan of the installations accompanied by the corresponding static calculations shall be submitted. The calculations shall be based on the actual loads anticipated during the work.”

(D. 23.5.1935.)

UNION OF SOVIET SOCIALIST REPUBLICS

“ 77. Before a hoist is put into use it shall be registered by the local labour authorities. When the building operations have been completed and the hoist is taken to pieces the registration certificate shall be returned to the local labour authorities.”

(O. 27.3.1931.)

(c) QUALIFICATIONS REQUIRED OF DRIVERS

AUSTRALIA

New South Wales

“ 17. (1) No person shall, in any district, act as driver in charge of any steam-crane used in connection with building operations unless he has obtained and holds a driver's certificate.

A driver's certificate shall be granted by the Government Architect to any person who, after inquiry and examination he considers is trustworthy and competent to act as a driver of a steam-crane. Any certificate so granted may be cancelled by the Government Architect if he considers that the holder has ceased to be trustworthy or competent as aforesaid.”

(A. 26.11.1912.)

Queensland

“ 45 (1) No person shall be employed or act in the capacity of engine-driver or engineer in charge of any engine or steam boiler to which this Act applies or be employed or act as boiler attendant of any such boiler, unless he is the holder of a certificate of competency under this Act of the grade prescribed for the engine or boiler in question.

.

(5) This section applies to all machinery, whether otherwise subject to this Act or not, with the exception of locomotives vested in or under the control of the Commissioner for Railways."

(A. 22.12.1915.)

" 12. A candidate for a crane-driver's certificate shall produce satisfactory evidence that he has had at least six months' experience in connection with engines used for the purpose of raising or lowering men or materials."

(A. 22.12.1915, Schedule.)

" 14. (1) (a) No lift, crane, or hoist shall be erected or materially altered or repaired or additions made thereto without first making application for and obtaining a permit from the Chief Inspector of Machinery."

(R. 24.12.1930.)

BULGARIA

" 48. The operation of hoisting appliances shall be entrusted to skilled workers . . ."

(O. 4.5.1935.)

CANADA

Alberta

" (73) Cranes shall be operated only by regular crane-operators, authorised substitutes, crane-repair men, or inspectors; no one else shall enter cage."

(R. 1928.)

UNITED STATES

California

" (a) On every construction job where a hoisting machine is used, one or more men shall be appointed as hoisting engineers. Every hoisting engineer shall be able to speak and read the English language readily and shall be physically fit to perform his duties. At all construction jobs where men are hoisted or lowered such hoisting engineers shall be not less than twenty-one years of age and on construction jobs where men are not hoisted or lowered they shall be not less than eighteen years of age. Every hoisting engineer shall be familiar with the details and workings of hoisting machines and no other person than the duly authorized hoisting engineer shall run hoisting engines or machinery on construction work."

(G.O. 1.7.1926, Order 1116.)

Wisconsin

" 2. *Operation of Elevators.* Every elevator which is used on a construction job shall have an operator stationed on the car at all times when persons are being carried. The operator shall be a person who is familiar with elevator equipment, preferably a representative of the elevator contractor but in any case shall be acceptable to the elevator contractor and the employer served by the elevator."

(G.O. 15.7.1933, Order 3528.)

GREAT BRITAIN

" 17. Every crane driver shall be properly qualified . . ."

(R. 30.9.1931.)

IRISH FREE STATE

As for Great Britain.

POLAND

“ 27.

(4) The installation and operation of hoisting appliances shall be entrusted to persons who are perfectly familiar with such appliances.

(D. 23.5.1935.)

SWITZERLAND

Geneva

“ 120. When power-driven appliances are used they shall only be operated by skilled workers.”

(R. 25.3.1930.)

CZECHOSLOVAKIA

Lifts and Hoists

“ 51.

(3) Only experienced workers shall be employed to operate lifts and hoisting apparatus.”

Cranes and Winches

“ 53. (3) The crane . . . shall be operated by a crane driver who is reliable and thoroughly acquainted with the entire apparatus.”

(O. 26.3.1931.)

UNION OF SOVIET SOCIALIST REPUBLICS

Travelling Cranes (American Derricks, Wharf Cranes, etc.)

“ (a) No driver shall be entrusted with the handling of the crane until the management of the workplace has checked his knowledge of and practical fitness for the work.”

(O. 5.5.1930, sec. 136.)

Hoists

“ 75. The management shall only allow trained and reliable mechanics to work on hoists.”

(O. 27.3.1931.)

(d) POSTING UP, ETC., OF REGULATIONS

GERMANY

See also under Chap. I, § 8 (e) “ Posting up of Regulations ”.

Jib Cranes

“ 117. The regulations concerning “ Crane attendance and operation ” (sections 34-49 and 110-116) shall be posted up.”

(R. 1.4.1934, Appendix IX, 2 (h).)

BELGIUM

(See under Chap. I, § 8 (e) “ Posting up of Regulations ”.

FINLAND

See also under Chap. I, § 8 (e) “ Posting up of Regulations ”.

“ 31. The instructions issued by the inspection authority respecting the maximum permissible load, and a prohibition of the use of the hoist for

the conveyance of persons or a statement of the conditions under which persons may be conveyed, shall be affixed at every landing.”

(Res. 15.11.1927.)

FRANCE, GREAT BRITAIN, LUXEMBURG

See under Chap. I, § 8 (e) “Posting up of Regulations”.

SWITZERLAND¹

Geneva

See also under Chap. I, § 8 (e) “Posting up of Regulations”.

“119. The regulations concerning the erection and handling of lifting appliances shall be posted up conspicuously in some part of the workplace.”

(R. 25.3.1930.)

UNION OF SOVIET SOCIALIST REPUBLICS

Travelling Cranes (American Derricks, Wharf Cranes, etc.)

“(k) The management of the workplace shall draw up and distribute to all crane-drivers and attendants detailed instructions for operating special types of cranes (industrial cranes, American derricks, etc.).”

(O. 5.5.1930, sec. 136.)

Hoists

“74. The management shall draw up instructions for hoist attendants. Such instructions shall fix the maximum load, prohibit workers from entering the hoist shaft or cage while the latter is in motion (section 73) ¹and prescribe the method of loading and unloading the cage, the signalling system, the way in which the gates shall be handled by the attendants, and any other safety measures.

These instructions shall be posted up where they can easily be seen at the loading and unloading points.”

(O. 27.3.1931.)

¹ See under § 5 (c) “Transport of Goods”.

PART III

INSPECTION

In this part are summarised legislative provisions concerning inspection of scaffolding and hoisting appliances by public authorities as distinct from the periodical inspection which in many countries has to be carried out by the builder, contractor, etc., or his representatives.

In some countries this official inspection is a matter for the general factory inspectorate or labour inspectorate, although in certain of these countries one or more factory inspectors may be specially detached for building inspection. In other countries special building inspectorates, scaffolding inspectorates, scaffolding and lifts inspectorates, or machinery inspectorates have been set up.

As in the previous part, it has not been possible to review the legislation of every State or province of Federal countries, and only a selection is dealt with here.

GERMANY

Under the Federal Industrial Code, the supervision of the enforcement of the statutory provisions for the protection of the workers' life and health is exercised by the factory inspectors.

In addition, the Federal Insurance Code requires the Mutual Accident Insurance Associations to enforce safety regulations, and for this purpose they are empowered to appoint technical inspection officials.

Between the State factory inspectors and the technical officials of the Accident Insurance Associations there is close collaboration. The new safety regulations of the Insurance Associations also serve to guide the factory inspectors when they have to take action in matters of safety. Both the factory inspectors and the technical

officials of the Insurance Associations have authority to give binding orders to the undertakings and to prosecute offenders.

Mention must also be made of the local building inspection authorities, which likewise have to supervise the enforcement of the safety regulations, and to many of which have been appointed so-called building inspectors (*Baukontrolleure*) who have risen from the ranks of the workers.

Lastly, with a view to promoting internal supervision in undertakings by the management or the workers, the regulations provide for the appointment of safety stewards, who have to satisfy themselves constantly of the presence and proper use of the prescribed safety devices, and see to the enforcement of safety measures in general.

In 1933, the 759 officials of the factory inspectorates carried out 20,240 inspections in 16,749 workplaces in the building industry, including ancillary undertakings.

The number of technical inspection officials of the Accident Insurance Associations in the building industry is about 120, and in addition there are some 15 officials of the Underground Construction Insurance Associations. All these officials are exclusively occupied in the inspection of construction operations.

ARGENTINA

The organisation, powers and duties of the Labour Inspectorate are regulated by Act No. 8999 of 30 September 1912 concerning the National Labour Department. This Act empowers inspectors to enter workplaces during working hours. Under an Act of 25 September 1929 inspectors were authorised to report offences, the inspector's report being deemed authentic until disproved.

A number of the Provinces also have their own Labour Inspectorates.

AUSTRALIA

New South Wales

The powers and duties of inspectors are laid down in the Act of 26 November 1912 to consolidate the Acts controlling scaffolding and lifts, and in the annexed regulations.

The functions of the Chief Inspector of Scaffolding and Lifts include the receipt of notices of intention to erect scaffolding, lifts, engines and steam cranes; the issue of permits for the erection or

alteration of lifts; the laying of information in cases where breaches of the provisions of the Scaffolding and Lifts Act have occurred; and such other powers as are vested in an inspector appointed for any district.

Inspectors must, from time to time, inspect all lifts and scaffolding and all engines, steam cranes and gear used in connection therewith in their districts, and for this purpose may enter any building or premises during working hours.

Where it appears to an inspector that the use of any lift, scaffolding, engine, steam crane or connected gear would be dangerous to life or limb or that as regards any of these appliances the regulations are not being complied with, he may give written directions to the owner, user or person in charge or apparently in charge, to prevent accidents or to ensure compliance with the regulations. The inspector may also order the cessation of work pending compliance with his directions. An appeal from the inspector's directions lies to the Government Architect or his representative.

Northern Territory

The Scaffolding Inspection Ordinance of 17 February 1932 empowers the Administrator to appoint inspectors. Inspectors may give directions for the prevention of accidents or for ensuring compliance with the regulations; they may also order the immediate cessation of work until their directions have been complied with. Every accident that causes loss of life or serious injury must be reported to the inspector, who must enquire into the cause of the accident and report to the Administrator. The Administrator may also direct an enquiry to be held by a special magistrate, assisted if considered desirable, by a scaffolding expert.

Queensland

Under the Inspection of Scaffolding Act of 22 December 1915 an inspector may at any time by day or by night enter any place where there is or where he has reason to believe there is any scaffolding or gear and may inspect and examine any found. For this purpose an inspector may examine the owner or any person present as to compliance with the Act. Occupiers and owners must give the inspector all reasonable facilities and information.

The powers of inspectors as regards the issuing of orders are similar to those in New South Wales but appeals lie to the police magistrates.

Section 20 of the Regulations annexed to the Act require inspectors to inspect all scaffolding or gear at least once in every three months. Any scaffolding or gear or parts not considered safe must be marked by the inspector as unfit for further use, and thereafter may not be used.

The inspection of hoisting gear is regulated by the Inspection of Machinery Act of 22 December 1915, under which the inspection system is similar to that under the Inspection of Scaffolding Act.

South Australia

Inspectors are appointed under the Scaffolding Inspection Act of 21 December 1907. They may order the remedying of defects, subject to an appeal to the competent Minister.

Victoria

Under the Scaffolding Inspection Act of 21 December 1922, inspectors must be appointed by every municipality to which the Act is made applicable. The powers and duties of inspectors are similar to those in the scaffolding Acts of the other Australian States.

Western Australia

Under the Scaffolding Inspection Act of 16 January 1925, the powers and duties of inspectors are similar to those under the Queensland legislation.

AUSTRIA

As regards inspection, building operations are covered by the Act relating to industrial inspection, dated 14 July 1921.

Under this Act, inspectors may visit establishments at any time, examine employees, require information, conduct investigations, have access to documents and issue orders.

In 1911 a special Building Inspectorate was established for Vienna.

According to the report of the Austrian Factory Inspectorate for 1934, out of a total of 19,495 building undertakings liable to accident insurance, 4,071 were inspected.

BELGIUM

The inspection system for industry in general is regulated by a Royal Decree of 22 October 1895 supplemented by a Royal Decree of 30 March 1921.

There are at present in Belgium 35 inspectors and 29 supervisors of labour in the inspection service. None of these officials is employed exclusively on the inspection of building work, which is supervised in the usual way along with all other industrial and commercial undertakings. It is therefore impossible to define the exact extent of the inspectors' activities as regards the building industry.

When an infringement of any of the legislative provisions comes to the notice of an inspector, he immediately requires the employer to take the necessary steps to remedy the matter. In the event of a second offence or deliberate failure to comply with instructions, the inspector draws up a report with a view to the prosecution of the culprit. This report is authentic until legally disproved.

If the infringement affects the part of the undertaking classified as dangerous, unhealthy or noxious, the inspector takes the same action, but, in addition, if the safety or health of the workers or persons in the vicinity is threatened and if the head of the undertaking refuses to carry out the instructions of the competent technical official, he can report to the burgomaster who will order the suspension of the dangerous or unhealthy work, place a seal on the appliances and, if necessary, close down the undertaking immediately.

The same powers may be exercised by the competent technical official if the burgomaster fails to take action or if the danger is so imminent that the least delay might cause an accident and the official has therefore no time to request the burgomaster to intervene.

In both cases mentioned in the preceding paragraphs, the head of the undertaking concerned may lodge an appeal with the responsible Minister, but this appeal does not stay the execution of the inspector's order.

The workers have no right to intervene in the supervision of undertakings, but they are entitled to draw the attention of the factory inspectors to breaches of regulations.

BULGARIA

Section 65 of the Order of 4 May 1935 concerning safety in constructional undertakings makes the labour inspectors responsible for reporting breaches of its provisions.

CANADA

Alberta

The Building Trades Protection Act of 1922 provides for the appointment of inspectors who are empowered to issue orders to secure compliance with any provision of the Act, and until such orders are carried out the work concerned must be suspended.

Manitoba. — As for *Alberta*.

Ontario. — As for *Alberta*.

Quebec

The Scaffolding Inspection Act of 1908 makes provision for the appointment of inspectors of scaffolding with authority to condemn dangerous scaffolding and to prosecute offenders.

Saskatchewan. — As for *Alberta*.

CHILE

The organisation, powers and duties of the General Labour Inspectorate are regulated by a Consolidation Decree of 15 November 1923. Under this Decree, inspectors have the task of inspecting undertakings, spreading knowledge of the social legislation, reporting offences, and issuing orders either directly or through their superiors.

CUBA

Labour inspection in general is regulated by an Act of 12 April 1935 (No. 91) fixing the organisation of the Secretariat of Labour, to a section of which—the Directorate General of Labour—the *Inspectorate is attached*.

Inspectors may enter any workplace during working hours to see whether the provisions of the social legislation are being complied with; they must report their findings to the Inspectorate, and may give orders and inflict fines.

The Secretariat also includes an Accident Prevention Department which has the duties of investigating safety conditions in industry, popularising protective measures and carrying on safety propaganda.

DENMARK

Except as regards lifting appliances building operations are not within the province of the Factory Inspectorate. The supreme inspection authority for building is the Ministry of the Interior. Supervision of the enforcement of such regulations as may exist is exercised by the building commissions, some of which have special building inspectors.

A new or reconstructed building hoist must not be put into operation before the competent factory inspector has inspected and passed it.

If a hoist is moved from one workplace to another the factory inspector must be notified.

Before any bucket hoist for concrete is put into operation the competent factory inspector (or in Copenhagen, the Lift Inspectorate) must be notified.

ECUADOR

Inspection is governed by the Regulations of 23 July 1926 issued under the Decree of 13 July 1926 establishing a Labour Inspectorate. Inspectors are empowered to visit workplaces at any time, and must do so at least once a year. They are required to report offences, suggest improvements in installations with a view to securing effective compliance with safety regulations, and in emergencies order the cessation of work. The reporting of accidents is also under their supervision.

SPAIN

Under the Royal Decree of 23 January 1916 concerning suspended scaffolds, the Labour Inspectors are made responsible for supervising the safety of scaffolds, and are empowered to issue summonses; and under the Act of 10 January 1922 on industrial accidents they are required to report offences.

A Royal Order of 29 April 1916 requires building operations to be notified to the inspector, and regulates the procedure in cases of differences of opinion between the inspector and the builder.

Regulations of 23 June 1932 lay down the organisation, powers and duties of the Labour Inspectorate. Inspectors may visit establishments at any time, examine documents, question employees, draw attention to defects in regard to safety and hygiene and issue orders for remedying them.

UNITED STATES

California

Inspection of scaffolds and building hoists is regulated by Chapter 590 of the Acts of 1911 (amended 1921, Chapter 334), and Chapters 148 (amended 1921, Chapter 333) and 275 (amended 1921, Chapter 332) of the Acts of 1913. Enforcement of the provisions for the protection of employees on buildings is a matter for the Industrial Accident Commission.

In particular, the Commission has the duty of inspecting all building hoists; it may order defects to be remedied and may prohibit the use of the hoists in the meantime.

Indiana

Under sections 3862 (*a-e*) of the Annotated Statutes of 1914 (as amended in Chapter 167 of the Acts of 1919), it is the duty of the building inspector of every city, or if there is no building inspector, then of the mayor or other local authority, to inspect or have inspected any building or part of a building or anything attached to a building in the course of erection or repair. The inspecting authority may order compliance with the regulations if they have been infringed and may prosecute offenders.

New York

Under section 240 (4) of Chapter 31 of the Consolidated Laws of 1909 (Labor Law) the State Industrial Commissioner must immediately inspect a scaffold or a mechanical device connected therewith concerning which complaint is made. If the scaffold or device is found unsafe, he must immediately notify the person responsible for it accordingly and prohibit its use until it has been made safe. The scaffolding regulations are enforceable by the Industrial Commissioner and the chief officer charged with the enforcement of the building laws of any city, town or village in the State, and for this purpose such officer has all the powers vested in the Commissioner.

Pennsylvania

Under section 2941 of the Statutes of 1920, whenever complaint is made to the Mayor, Director of Public Safety, Superintendent of Police or other person in charge of the police force in any city of the first, second or third class in the State that scaffolding or

any scaffold parts or accessories are unsafe or liable to prove dangerous to life or limb, such official must immediately have an inspection carried out. If the official finds the scaffolding, etc., to be dangerous to life or limb, he must prohibit its use and order it to be made safe. Any person whose duty it is to examine or test any scaffold or scaffold part must be allowed free access at all reasonable hours to any building or premises containing it or in which it may be used.

Wisconsin

The inspection of scaffolding and building hoists is regulated by the chapter on the Industrial Commission in the Statutes of 1923. Here it is laid down that any Commissioner or deputy of the Commission may enter any place of employment at all reasonable hours for the purpose of collecting facts and statistics, examining the provisions made for the health, safety and welfare of the employees, and bringing to the attention of the employer or owner any law or order of the Commission and any failure on the part of such employer or owner to comply therewith.

The Commission is given the power of requiring protection of the life, safety and welfare of all employees, and investigating and prescribing what safety devices, safeguards and other means of protection are best adapted to render employees and places of employment safe.

If a complaint is made that a place of employment is not safe the Commission must, or if it otherwise learns that a place is not safe it may, make an investigation and may order the place to be made safe.

FINLAND

According to the Labour Inspection Act of 4 March 1927 and the regulations under that Act, buildings under construction or repair are registered with the communal inspectors and supervised by them.

If, on inspection, a communal inspector finds that the conditions obtaining or the devices employed are defective, he reports to the competent State labour inspector, who then sends written notice to the employer requesting him to remedy the defects in the manner indicated in the inspector's report.

If workers are exposed to obvious accident risk or danger to life the communal inspector may order the work to be suspended until

the danger has been removed or a decision in the matter has been taken by the Ministry of Social Affairs; when such order is given the communal inspector has to inform the competent State labour inspector immediately.

According to the Annual Report on the activity of the labour inspectorate in 1934, the number of buildings (under construction or repair) liable to inspection was 2,066; the number of inspections carried out in these buildings was 2,870.

FRANCE

The organisation of factory inspection is regulated by Book II of the Labour Code of 1912 and by various Decrees issued under its provisions.

There are no inspectors specially appointed to supervise safety measures in the building industry. It is the ordinary staff of the inspectorate, responsible for the enforcement of the labour legislation in general, that exercises this supervision. It should, however, be noted that in Paris one inspector is specially engaged in supervising the enforcement of the labour legislation in the construction work on the Metropolitan railway.

The labour inspectorate comprises 12 divisional inspectors, 132 departmental inspectors and 30 departmental women inspectors.

Under the Act of 9 March 1931 amending section 68 of Book II of the Labour Code, as regards numerous provisions of the decree of 1925 issuing safety and hygiene regulations for buildings and public works under construction, the formality of cautioning offenders has been done away with by the amending decree of 26 November 1934. In the cases concerned, any offences noted may now give rise to prosecution without delay, and consequently the labour inspectorate will be able to act more effectively.

GREAT BRITAIN

The organisation of factory inspection is regulated by the Factory and Workshop Act of 1901 and subsequent amendments.

Any inspector of factories may inspect a building or investigate an accident upon a building in the area assigned to him, although in the large cities where important buildings are always to be found under construction the inspection of buildings is mainly carried out by a divisional inspector or some other inspector with special knowledge or qualifications for the work, but it has not

been found necessary for such inspectors to devote the whole of their time to the inspection of buildings. These inspectors investigate accidents and check the observance of the codes of building regulations and other requirements of the Factory and Workshop Acts.

If an accident occurs, the employer must notify the inspector in so far as section 28 of the Workmen's Compensation Act 1923 and the other Acts mentioned in this section are applicable. This section applies as if any premises on which machinery worked by mechanical power is temporarily used in the construction of a building or any structural work in connection with a building were a factory, and as if the purpose for which the machinery is used were a manufacturing process.

In the case of buildings over 30 feet in height which are being constructed or repaired by means of scaffolding, notification of an accident must be sent to the inspector whether machinery is used or not.

This requirement also applies to any private line or siding used in connection with a building in course of construction or repair as above.

To facilitate the work of inspectors at buildings under construction, a general register must be kept relating to accidents, steam boilers, scaffolding, cranes, etc.

The workers take no part in the supervision of safety.

GREECE

The enforcement of the Industrial Safety Act of 1911 is placed under the supervision of the Labour Inspectorate.

The organisation, powers and duties of the Labour Inspectorate are defined in a Decree of 17 September 1934, codifying the statutory provisions concerning the Inspectorate. Under this Decree inspectors may visit a workplace at any hour of the day or night if work is being carried on, and are required to report to the Chief Inspector on their visits.

HUNGARY

The activities of the Hungarian Factory Inspectorate are regulated by Act No. XXVIII of 1893 concerning factory inspectors and the protection of industrial and factory workers against accidents.

Under section 14 of this Act, the factory inspectors must see that factories and the larger industrial establishments comply with the safety laws and regulations, and in particular that the necessary measures are taken to prevent accidents and to safeguard the life, limb and health of the workers employed.

An Order of 1898 extended the scope of the inspectors' activities to cover building operations. The supervision of building operations throughout the whole country is in the hands of a single inspector, a certificated building engineer, whose headquarters are in the District Factory Inspectorate, Budapest.

Before any building work is undertaken, the lower factory authorities must inform the district factory inspectors, who report to the Chief Building Inspector in Budapest. When doing so, they must specify the extent of the building operations (single-storeyed or multi-storeyed house, block of flats, factory, etc.) and the number of workers to be employed, so that the Chief Inspector can devote special attention to the more extensive schemes.

When a building permit has been duly obtained, building work can be commenced or continued, irrespective of whether the building has been visited by the inspector or not.

The sole purpose of the inspector's visit is to ensure that the provisions of the legislation concerning accident prevention and factory inspection are being complied with—by the authorities concerned as well as by the builders. Consequently, the inspector's visit does not relieve the local police and technical authorities of their responsibility for exercising supervision in their respective spheres.

There are no detailed regulations as to the points to be considered by the inspector when visiting building operations. As there are no detailed safety rules, the safety measures that may be ordered are at the discretion of the building inspector.

ITALY

Act No. 886 of 16 June 1932 on the establishment of the Corporative Factory Inspectorate contains provisions on the Inspectorate's organisation and duties. Under section 5a instructions given by the inspectors for the prevention of accidents are mandatory. Appeals may be lodged with the Ministry of Corporations but do not effect a stay of execution, except where this is specially provided for in statutory provisions or regulations or the Minister reserves the right to order it.

The duties in connection with supervision of the enforcement

of the regulations concerning labour, social assistance and welfare are performed exclusively by the corporative inspectorate.

The National Association for Industrial Safety Propaganda (*Ente nazionale di propaganda per la prevenzione degli infortuni*) has the duty of giving information, instruction and advice on technical, sanitary and health matters. It is in close touch with the Factory Inspectorate, industrial associations and insurance institutions. Its functions include the issue of permits for electrical plant, lifts and other hoisting appliances, hydro-extractors, ladders, etc., and the manufacture of safety devices.

JAPAN

At present the factory inspectors are empowered to inspect construction work only for the purposes of the Workmen's Compensation Act, and not for the enforcement of safety measures; but when safety regulations now in preparation are issued, the inspectors' powers will be extended to include the supervision of safety.

In the prefectures where building regulations exist, the prefectural inspectors are empowered to inspect buildings under construction.

LUXEMBURG

The organisation, powers and duties of the Labour Inspectorate are laid down in the Act of 22 May 1902 and in regulations issued under the Act.

Inspectors have the right to enter workplaces, carry out enquiries, call for documents and report offences; they may be assisted by workers' delegates selected from candidates proposed by the sickness insurance institutions.

Under the Act of 28 August 1924 respecting the health and safety of persons employed in workshops, in industrial and commercial undertakings, or in work in construction, adaptation, repairs or excavation, enforcement of public administrative regulations issued pursuant to the Act is a matter for officials of the Labour Inspection Department.

MEXICO

The organisation, powers and duties of labour inspectorates are laid down in the Federal Labour Act, and the Regulations of

25 October 1934 issued under the Act. Inspectors may visit undertakings at any hour of the day or night, question employees in the absence of witnesses, make inspections in the company of experts or of workmen belonging to the undertaking, require the production of documents, and issue orders; and they must report irregularities, and keep records of accidents.

Special provisions concerning the inspection of wholly or partly suspended scaffolds are contained in the Regulations for the Prevention of Accidents dated 28 November 1934.

Such scaffolds may not be used until they have been certified by a building inspector to be sufficiently strong and safe and to comply with the scaffolding regulations. Once the work has begun it is the duty of the factory inspectors to see that scaffolds satisfy these conditions. An inspector must report unsafe conditions and breaches of the regulations, and appropriate legal action is taken upon his report.

If an inspector notices dangerous conditions which cannot be immediately remedied he must suspend operations on the scaffold until it is made safe.

In the event of a difference of opinion between the inspector and the engineer in charge of the works, as to the interpretation of the scaffolding regulations, the inspector's orders must be obeyed.

NORWAY

Building operations are not within the province of the Factory Inspectorate. Inspection of buildings under construction and supervision of the enforcement of the relevant regulations are matters for the local building authorities. These include the Chief of Police, the Municipal Building Director (where one exists) and the Chief of the Fire Brigade. In the larger towns special technical officials (building inspectors) are usually appointed and their powers include the supervision of buildings under construction.

NEW ZEALAND

The powers and duties of inspectors are regulated as regards scaffolding by the Act of 31 October 1922 (amended 29 October 1924), and as regards machinery by the Act of 2 October 1928 (amended 11 November 1931).

Scaffolding inspectors may at any reasonable hour by day or by night enter any building or place where there is, or is believed

to be, any scaffolding, crane or gear and may carry out an inspection to ascertain whether the regulations are being complied with. They may issue written orders to secure compliance or to prevent accidents, order the cessation of work pending the remedying of defects, condemn any scaffolding and crane and order it to be dismantled, condemn gear and have it rendered useless. Appeals against the inspector's orders may be lodged with a magistrate, whose decision is final.

Inspectors must also be notified of serious accidents and enquire into the circumstances.

Under the Inspection of Machinery Act, owners of machinery must, within one month of acquiring it, notify the inspector, and when requesting the first inspection of any boiler, lift or crane, must send drawings thereof to the Chief Inspector of Machinery. Lifts must be inspected every six months and other machinery every year. On the report of an inspector the Secretary of the Marine Department may cancel or suspend any machinery certificate.

The powers and duties of machinery inspectors are similar to those of scaffolding inspectors.

NETHERLANDS

Responsibility for detecting offences against the statutory provisions rests with the gendarmerie, all officials of the State and communal police, and officials of the Factory Inspectorate.

The Factory Inspectorate was created by the Labour Act of 1889 (amended 1895, 1919, 1922) and reorganised on various occasions by Royal Orders. In the ten inspection districts there are, at present, about forty-five officials engaged in the inspection of building operations.

The more detailed regulations issued by the divisional factory inspector in application of the statutory provisions are explained in leaflets showing how the provisions must be complied with in practice.

In general, owing to insufficient technical training in safety matters, it is only rarely that the police officials verify safety in building construction. An exception, however, is constituted by the officials of the building authorities, who are to be found in the larger towns—e.g. The Hague and Amsterdam—and regularly supervise building safety. In Rotterdam the building police have

a special official at their disposal, whose sole duty is the supervision of safety measures.

The communal authorities are not empowered to prescribe safety measures for building workers, but they can prescribe the measures to be taken by the builder in the interests of public safety, and thus the communal regulations contain provisions also affecting building workers.

In the last few years there has been a growing tendency to erect bigger and higher buildings without the builders or the authorities possessing the necessary experience as regards the scaffolding required for them. Accordingly, in 1928 the Minister of Labour, Trade and Industry set up a committee to compile a guide book of measures for the furtherance of safety in building, and in particular on scaffolds for high buildings.

POLAND

The legislative provisions concerning inspection are contained in the Decree of the President of the Republic dated 14 July 1927 concerning labour inspection.

All undertakings employing paid labour are liable to inspection. The duty of the inspectors is to supervise the enforcement of the legislative provisions concerning the protection of labour, and in particular the protection of the worker's life, limb and health.

The inspectors' powers in the domain of safety vary according to the regulations in force in the different provinces, but generally speaking these powers are very wide. The inspectors are consulted, in so far as concerns industrial safety and hygiene, for the purpose of authorising the opening or alteration of industrial establishments; they may draw up reports and issue binding orders for the removal of defects, prosecute offenders in the local courts, and order the closing down of undertakings when the technical installations are so defective that no alteration would suffice to protect the worker's life and health.

RUMANIA

The organisation of the Factory Inspectorate is regulated by an Act of 11 April 1927. This Act contains no provisions specially concerning inspection of buildings under construction; but in general inspectors are entitled to enter and inspect at any hour of the day or night any premises where they have reasonable

grounds for supposing that persons protected by the law are employed; and to enter during the day all premises which they have reasonable grounds for supposing to be establishments subject to their supervision or dependencies of such establishments. Wherever possible they must give notice of their visits, and the employer or his representative may accompany them during their inspection. They may question employees in the absence of witnesses, call for documents and report offences. They may also be accompanied at their discretion by authorised delegates of chambers of labour or lawfully constituted trade associations. Inspectors who are engineers or approved technical experts may give binding orders to secure compliance with the health and safety regulations.

SWEDEN

Workplaces in the building industry are registered with the communal inspectors, but are subject to the supervision not only of these inspectors but also of the State inspectors (factory inspectors and assistant inspectors). The inspectors may give instructions and advice to undertakings concerning the removal of defects, but they are not empowered to issue binding orders. If an undertaking does not comply with instructions, the State inspectors may report to the competent provincial authorities with a view to compelling observance of the regulations. If there is an offence against the safety regulations, a factory inspector may also report this to the Social Board, and the Board in certain cases can have the work stopped.

SWITZERLAND

Under the Sickness and Accident Insurance Act of 13 June 1911, which applies to the building industry, the occupier or his representative is required to take all such measures for the prevention of illness and accidents as experience shows to be necessary, and technique and the particular conditions allow. The National Accident Insurance Institute, after consulting the parties concerned, may issue Orders against which an appeal lies to the Federal Council. The Act also contains provisions concerning the reporting and investigation of accidents.

It is only recently, however, that the Institute has been able to deal closely with the construction industry, and its activities in this field are still in course of development.

Persons with experience of the industry have been appointed and are being trained as technical inspectors. As regards building construction, the inspectors will be guided provisionally by draft safety regulations which the Institute has framed for submission to the Federal Council. If the Council issues the regulations supervision of their enforcement will fall to the Institute's inspectors.

The federal legislation has been supplemented in many cantons and communes by laws and regulations issued by the competent local authorities. It is not the Institute's intention to interfere with the safety organisations of these local bodies if their activities are compatible with those of the Institute. The question of co-operation between the Institute's inspectors and local inspectors in the building industry has not yet been settled.

An example of cantonal legislation concerning inspection is given below.

Geneva

In an Order respecting the safety of workers employed in the repair or construction of buildings, dated 17 February 1928, the Government reserves the right to cause buildings under construction and repair to be inspected at any time. If the safety of the workers or the public is endangered work may be stopped or urgent precautions taken at the contractor's expense. The administration of these provisions is in the hands of the Department of Public Works, to which complaints may be addressed, but officials of the Department of Justice and Police and the Department of Public Health may investigate and report offences and if necessary take legal proceedings.

CZECHOSLOVAKIA

Factory inspection in general is still regulated by the Austrian Act of 17 June 1883. Inspectors may enter workplaces at any time, hear employees, and report offences.

By an Order of 23 March 1920, special inspectorates for the building industry were established for Prague and Brno.

TURKEY

An Act of 25 April 1916 on municipalities first provided for the supervision and inspection of industrial establishments from the

point of view of safety (section 4); but at the present time it is the Act of 3 April 1930 and the Administrative Regulations issued under it which regulate these matters. Municipalities, which must be established in all towns with a population exceeding 2,000, as well as in certain other localities, are empowered to exercise supervision over building construction from the point of view of safety, and to punish offenders. Further, the provincial industrial departments of the Ministry of National Economy are responsible for the enforcement of the Act of 1913 on power plant.

UNION OF SOVIET SOCIALIST REPUBLICS

Under the Labour Code, supervision of the enforcement of all regulations concerning industrial safety is a matter for a special organisation consisting of labour inspectors, sanitary inspectors and technical inspectors. The powers and duties of inspectors are defined in the instructions for the inspection of labour issued by the People's Labour Commissariat of the U.S.S.R. on 24 December 1925 (No. 322/415).

The jurisdiction of the inspectors as regards the protection of labour extends to all establishments and undertakings without exception. It is the sanitary and technical inspectors who are specially responsible for the supervision of undertakings as regards hygiene and safety, but the labour inspectors, who are entrusted with the general direction of all measures relating to the protection of labour, are also competent in this domain. Thus in small industrial undertakings, owing to the absence of any appreciable difficulty in accident prevention, supervision in this respect is exercised exclusively and directly by the labour inspector. In medium, and more especially in very large undertakings, the labour inspector's decisions in accident prevention matters must be taken in agreement with the special inspectors.

With a view to improving labour protection and safety measures, the Council of People's Commissaries of the U.S.S.R. decided by Order of 30 June 1931 to appoint public labour protection inspectors in all State undertakings, transport, constructional work, etc. These inspectors are appointed by the Works Committees and the local committees of the trade unions from among the "shock workers" and the members of the engineering and technical staff who belong to trade unions. They work under the supervision of the State labour inspectors.

The inspectors have very wide powers: in the performance of

their duties they may take special measures in emergencies, issue orders, prosecute offenders, close down undertakings, grant exemptions from certain regulations, etc.

The practical application of these legislative measures concerning safety in the building industry is facilitated by instructions, circulars, etc., from the Labour Commissariat to the competent authorities.

UNION OF SOUTH AFRICA

As regards *scaffolding*, inspection is not regulated by Union legislation but is a matter for the municipalities. The regulation in force in Capetown and Johannesburg may be taken as typical examples of municipal regulations.

In *Capetown* the City Engineer must be given 48 hours' notice of intention to erect a needle scaffold. Every facility must be afforded to the City Engineer (or other duly authorised officer of the City Council) to inspect any needle scaffold during or after erection, and orders given by him must be carried out immediately by the contractor or other person responsible for the work.

In *Johannesburg* the Town Engineer or his assistants may inspect any scaffolding, rope, planking, etc., may order defects to be remedied, and prevent the use of defective equipment and appliances until the defects have been remedied.

The inspection of *machinery* is regulated by Part II of the Act of 5 June 1931 to amend the Factories Act, 1918, and to provide for the supervision and control of certain machinery; and by the Regulations of 31 July 1931 issued under the Act.

All machinery is subject to the supervision of the Chief Inspector of Factories and his subordinate inspectors.

Inspectors may hold enquiries into fatal or non-fatal accidents or other occurrences; they are empowered to enter, at any reasonable time, any place where there is any machinery, and to inspect such machinery.

Users of machinery subject to the Regulations of 31 July 1931 must report to the Divisional Inspector of Labour. Certain classes of accident or dangerous occurrence must be notified to him, whether personal injury is caused or not. All reportable accidents must be entered in a register. Appeals from inspectors' decisions or instructions may be lodged with the Chief Inspector of Factories.

URUGUAY

Under the Industrial Safety Regulations of 14 April 1945, inspection of building operations is assigned to building inspectors attached to the Directorate of Internal Taxation.

YUGOSLAVIA

The organisation, powers and duties of the Labour Inspectorate are laid down in the Act of 20 December 1921, which provides for the creation of a special inspectorate for the building trade. This inspectorate is given the same powers and duties as the provincial labour inspectorates. Provincial inspectors may enter undertakings at any time, call in experts, examine documents, require information, designate the persons to accompany them during inspections, issue orders and impose penalties for offences respecting the protection of workers.

PART IV

SAFETY ACTIVITIES OF EMPLOYERS' AND WORKERS' ORGANISATIONS

§ 1. — Statutory Organisations

In some countries building undertakings, in common with other industrial undertakings, are required by law to set up Safety Committees or Works Councils invested with safety duties, or the workers have the right of electing from among their number one or more safety delegates to represent them in matters of industrial safety and hygiene. Where this is so the law regulates the appointment, composition and duties of the Committee, Council or Delegates. This is the case in Austria, Canada (Alberta), Czechoslovakia, Germany, Luxemburg, Mexico, Sweden and Yugoslavia, and the arrangements in force in these countries are summarised below.

In the Union of Soviet Socialist Republics the duties of the workers in connection with safety are closely bound up with the inspection system and are dealt with in Part III, "Inspection".

GERMANY

The co-operation of employers and workers in accident prevention is regulated by certain provisions (based on those of the Act for the Regulation of National Labour of 12 January 1934) incorporated in the safety regulations of the Mutual Accident Insurance Associations concerned.

These provisions may be summarised as follows:

The employer is required to promote the co-operation of his employees in accident prevention.

In undertakings usually employing at least 20 persons the employer must appoint one or more safety stewards (*Unfallvertrauensmänner*), their number depending on the nature and size of the undertaking. Where a Trust Council (*Vertrauensrat*) exists, the stewards must be appointed in consultation with the Council.

When the Works Trust Council delegates its duties in the matter of safety to certain of its members, the employer must appoint additional safety stewards if the said members are not sufficiently numerous. In the interests of safety the safety stewards should be changed as little as possible.

In undertakings usually employing less than 20 persons the employer must appoint one or more safety stewards, according to the nature of the undertaking.

It is the duty of the safety stewards to satisfy themselves at all times as to the presence and proper use of the prescribed safety devices and to watch over the application of safety measures in general. In particular, they should report defects to the manager, make such proposals for improvements as their experience suggests, and arouse their workmates' interest in accident prevention. These duties should be performed in the closest possible contact with the Trust Council.

The employer must afford the competent safety steward an opportunity of accompanying the official technical inspector on his visits of inspection, and must acquaint the inspector with any observations on the steward's part concerning defects in the equipment, or suggestions for improvements in safety devices. If so requested he must bring the inspection report to the safety steward's notice. If he raises objections, the matter is decided by the Accident Insurance Association.

Should the employer delegate his duties in the matter of safety to managers, this must be confirmed in a written statement signed by both parties. The statement must be submitted to the technical inspector upon his request, and a copy must be given to the person assuming responsibility by virtue of his signature.

AUSTRIA

The statutory body concerned with safety in Austrian industrial undertakings is the "works community" (*Werksgemeinschaft*) set up under an Act of 12 July 1934.

In undertakings, including building undertakings, in which at least five persons are regularly employed, trustees for the workers (*Vertrauensmänner*) must be elected, their number varying with the size of the undertaking, subject to a maximum of ten.

In undertakings in which at least 20 persons are regularly employed, the trustees together with the occupier form the works community.

One of the duties of the works community is to promote compliance with the regulations concerning industrial hygiene and safety, and if necessary to appeal to the competent authorities.

When carrying out inspections the factory inspectors must as far as possible be accompanied by trustees.

The Act contains detailed provisions concerning the election and procedure of works communities.

CANADA (Alberta)

Under Regulations issued in 1928 by the Workmen's Compensation Board acting under the Workmen's Compensation Act, every undertaking within the Act where ten or more workmen are employed must have an accident prevention Committee of not less than two members.

The duties of these Committees are as follows:

- (a) To make a thorough inspection not less than once a month of the entire plant or place of employment for the purpose of receiving complaints, determining hazardous conditions, and receiving recommendations for their improvement.
- (b) To hold regular meetings at least monthly for the discussion of Accident Prevention, to investigate all serious accidents, to report their findings and recommendations to their employers, keeping a copy in the records of the Committee which must be available at any time to the Workmen's Compensation Board or its officers.
- (c) To educate their fellow-employees against dangerous practices and methods of work.
- (d) To investigate fire conditions, examine fire-escapes, fire-extinguishers, water-buckets, sand-buckets and all fire-fighting appliances.
- (e) To inspect lighting arrangements in all places of employment, and to report to the employers all insufficiently lighted passage-ways and other places where workmen are liable to be injured in the course of their employment.
- (f) To inspect or to arrange for the inspection of all machinery and equipment.
- (g) To provide at each establishment facilities for receiving written complaints and recommendations.

LUXEMBURG

Co-operation in the prevention of accidents and sickness is one of the duties of the Workers' Committees established under the Order of 8 May 1925. The Committees are also required to assist the industrial inspectors and other authorities by making suitable proposals.

A permanent Workers' Committee must be set up in every industrial establishment where as a rule at least 20 workers are employed.

The membership of these Committees is fixed as follows:

20-50 workers	1 member
51-80 „	2 members
81-100 „	3 „
101-150 „	4 „
151-200 „	5 „

If there are more than 200 workers one member is added to the Committee for every additional 100 workers, subject to a maximum membership of 15. For each full member there must be one substitute member.

A Committee is elected by all the workers who are 18 years of age, who are in possession of their civil rights and who have been in the continuous employ of the undertaking for six months (in the case of alien workers, twelve months).

Members of the Committee must be 25 years of age, be in possession of their civil rights, have worked continuously in the undertaking for at least a year, and have been employed for at least three consecutive years in the same industry. Additional restrictions are imposed upon alien workers.

The Committee serves for two years. It may meet once a month during working hours. Ordinarily, the employer may be invited to attend, but must leave when votes are taken. However, meetings may sometimes be convened by the employer (or his representative), in which case he (or his representative) is entitled to attend. Further, the Government may send an official to the meeting, and his statement must be heard.

MEXICO

The appointment, composition and functions of Safety Committees in industrial undertakings of all kinds are governed by Chapter II of Regulations for the Prevention of Accidents, issued on 28 November 1934.

Under these regulations a permanent Safety Committee consisting of representatives of the employer and of the workers in equal numbers must be set up in every undertaking.

Members of the Committee must be generally suitable for their duties; the workers' representatives are appointed by the trade union concerned, or in default, are elected directly by the workers.

The duties of the Committee are defined as follows:

- (a) To investigate the causes of accidents and occupational diseases;
- (b) To take steps to prevent them;
- (c) To ensure compliance with the present Regulations and the Regulations concerning Industrial Hygiene;
- (d) To see that the preventive measures they prescribe are enforced;
- (e) To bring to the notice of the employer and of the labour inspectors any infringements of the regulations in force so as to prevent accidents and occupational diseases;
- (f) To instruct the workers in safety measures;
- (g) To put into practice all safety principles.

The Committee must meet once a month and keep minutes of its meetings. The minutes are communicated to the employer, the trade union and the competent authority. The purpose of the meetings is to discuss investigations into any accidents that have occurred, together with their causes, and means for preventing their recurrence.

The Committee may consult experts as to the precautions to be taken for work or machines with which it is unacquainted.

Inspections must be carried out by the Committee at least once a month to see that the safety provisions are being observed.

NETHERLANDS

An Act of 2 July 1934 to issue safety regulations for work in general and factories and workplaces in particular, which applies to building construction, repair or demolition, provides that safety committees may be set up or approved for the purpose of promoting safety and hygiene in undertakings. When the Crown is of opinion that safety committees should be appointed in a particular industry, rules for such committees will be issued by means of public administrative regulations after consultation with the industrial council

concerned, or in default of such council, employers' and workers' organisations. The rules will contain provisions respecting the composition, powers, procedure and duties of the safety committees, and the duties of heads of undertakings and employees towards the committees. Approval of a safety committee may be withdrawn if it fails in its duty. Rules may be issued by public administrative regulations respecting grants from State funds to promote the institution and maintenance of safety committees.

SWEDEN

Under Section 31 of the Labour Protection Act of 29 June 1912 as amended on 12 June 1931, in building undertakings in which at least ten workers are regularly employed, the workers are urged to elect from among their number one or more delegates to represent them in matters of industrial safety and hygiene; and on such matters the delegates must be consulted by the management.

Delegates must acquaint themselves with the conditions in the undertaking as regards safety and hygiene, and endeavour to promote improvements, seeking the co-operation of the workers for this purpose. If a delegate becomes aware of unsatisfactory conditions he must apply to the management to have them remedied. Should he fail to obtain satisfaction he must appeal to the competent industrial inspector.

When inspecting a workplace the official inspector must as a rule get into touch with the workers' delegate if there is one. Further, at the request of a workers' delegate the competent inspection authority must supply him free of charge with copies of any written instructions, advice, etc., given with regard to safety or hygiene at the workplace.

CZECHOSLOVAKIA

Safety Committees are not statutory bodies in Czechoslovakia, but the Works Councils Act of 12 August 1921 conferred certain duties connected with safety on the Works Councils. These duties are: to see that the statutory provisions for the protection of employees are observed, especially those dealing with accident prevention, hygiene and insurance; to inform the works management of any defects observed; to appeal to the competent State authorities when necessary; to appoint one member of the Com-

mittee to take part in all investigations (and Committee proceedings in connection with them) which may be undertaken at the works by the official inspection authorities; and to make proposals for the improvement of the works, especially as regards technical installations, protection of the workers, methods of work, etc.

A Works Council must be established in every independent undertaking employing not less than 30 persons regularly throughout the year.

In works with 30-60 employees the Works Council consists of three members; in works with 61-100 employees, four members; one member is added to the Council for every additional hundred employees up to 400, one for every additional two hundred from 401 to 1,000 employees, one for every additional five hundred from 1,001 to 4,000, and one for every additional two thousand above 4,000, subject to a maximum of twenty members.

Members of the Council must be at least 26 years of age and as a rule have been employed for at least twelve months in the undertaking; they must also have worked in the industry or occupation in question for not less than 3 years.

The right to vote at elections for Works Councils is possessed by persons whose employment in the works is their principal livelihood, who have been in the undertaking's employ for not less than 3 months, and who are 20 years of age.

The Council serves for one year.

The employer is entitled to attend, or be represented at, the meetings and also to receive a copy of the minutes, which must be kept regularly and signed.

YUGOSLAVIA

Under the Workers' Protection Act of 28 February 1922, employees in building undertakings are entitled to elect representatives who are entrusted with certain duties in connection with accident prevention. In particular they must insist on strict compliance with legislative and administrative requirements regarding protection of the workers, and give information and assistance to the competent authorities in all matters connected with the enforcement of labour protection legislation. The election and activities of these representatives are regulated in detail by the Act.

§ 2. — Voluntary Organisations

In this section accounts are given only of organisations mainly or exclusively concerned with building or building and public works. There are, of course, a large number of countries possessing industrial safety organisations of a general character whose range of activity includes the building industry, but it would take too long to describe the work of every one.

Examples of such general safety organisations are the Association of Belgian Manufacturers (*Association des Industriels de Belgique*), the Industrial Accident Prevention Associations of Toronto, and the National Safety Council, Chicago.

The promotion of safety in building construction, as in other industries, is also frequently undertaken by insurance companies or institutions, e.g. The Travelers' Insurance Company of Hartford, Connecticut, The National Employers' Mutual General Insurance Association Ltd., London.

A third type of organisation partly engaged in safety activities is exemplified by the American Standards Association whose main purpose is the promotion of standardisation throughout trade and industry but which has also compiled several safety codes.

Some organisations catering mainly or exclusively for the building and public works industry are briefly described below.

UNITED STATES

A considerable amount of safety work has been done in the United States by federations of building contractors, such as the Associated General Contractors of America, the General Builders' Association of Detroit and the Building Trade Employers Association of New York.

These federations have established safety departments or committees and engage in safety work generally; in particular they have published safety codes, manuals, pamphlets, etc., for building operations.

In June 1927, the Workers' Health Bureau, a trade union health research organisation, called a conference of delegates from trade unions throughout the country to formulate national trade union safety standards for the protection of workers in the most important organised trades. Safety standards for the building

trades were allotted to a committee representing the leading building trade unions in various sections of the country.

This Committee secured the co-operation of the American Institute of Architects, which appointed a delegation to represent it for the purpose in view.

The joint Committee thus formed compiled a "Safety Code for Workers in the Construction Industry" which was published in 1929. It was intended for the use of trade unions in negotiations with their employers, and in efforts to improve State and city regulations, but could also serve as a nationwide uniform standard of safety in the construction industry.

FRANCE

There are a number of voluntary associations in France engaged wholly or partly in the promotion of safety in the building industry. Among the most important are the General Guarantee Association of the Trade Chambers in the Building and Public Works Industries (*Syndicat général de garantie des Chambres Syndicales du Bâtiment et des Travaux publics*), the Apprenticeship Chamber for the Masonry and Reinforced Concrete Industries and the Industrial Federation of the Building Material Trades (*Chambre d'apprentissage de la maçonnerie, du béton armé et de la Fédération industrielle des matériaux de construction*), the Securitas Association (*Le Bureau Securitas*), the Corporative Association for Hygiene and Safety in Building Construction (*Société Corporative d'hygiène et de sécurité dans les chantiers*) and the Technical Federation of the Building and Public Works Industries (*Union technique du Bâtiment et des Travaux publics*).

The General Guarantee Association of the Trade Chambers in the Building and Public Works Industries is an industrial accident insurance institution of long standing, which has devoted very considerable activity to safety matters.

In the first place the Association has a safety department staffed by safety engineers and technical inspectors. This department inspects buildings, etc., under construction and reports to the Association. If it is found that the safety regulations are not being observed the builder's notice is called to the fact by the inspector and when necessary also, in writing, by the Association. In the event of persistent refusal by the builder to comply, the Association may raise his insurance premium, or in serious cases suspend its guarantee. The Association's aim, however, is to

co-operate in a friendly spirit with builders and it is extremely rare that coercive measures are called for after visits of inspection. The Safety Department also keeps in close touch with the safety engineers that a number of large firms are now employing.

In addition to this practical work the Association engages in extensive educational and propaganda activities. These have resulted in the publication of articles in the paper *Bâtiment et Travaux publics*, and also of several safety codes and pamphlets applying to building construction. Among these, special mention may be made of a general safety pamphlet for the building trades, and special pamphlets on roof work, etc.; hoisting appliances; painting, glass work and renovation; wire ropes.

In conjunction with the Apprenticeship Chamber for the Masonry and Reinforced Concrete Industries, etc., the Association recently published a comprehensive safety manual for masonry work.

The Apprenticeship Chamber for the Masonry and Reinforced Concrete Industries dates from 1931. Its purpose is the general organisation of apprenticeship in the building and allied trades. Its activities, which are mainly educational, include theoretical and practical courses on industrial hygiene and safety and also safety propaganda by means of pamphlets, posters, etc.

The Securitas Association was founded in 1929 as a non-profit-making concern, under the auspices of the General Office for Building and Public Works, which is a federation of associations of architects, master builders and public works contractors. Its purpose is to ensure soundness of construction with a view to the prevention of accidents. To this end it examines the plans before the commencement of each stage in the construction, and carries out inspections on the spot to see that the work is in conformity with the plans and is being properly done. It also acts as an advisory body, and furnishes technical information to those in the trade, insurance companies, public authorities, etc.

If the builder refuses to correct mistakes or to adopt safe practices, the Association suspends or ceases its supervision and may report him to the insurance company.

The Association tests and analyses materials in various official laboratories and has also established a laboratory of its own for these purposes.

Further, it supervises mechanical and other installations such as ventilation, lifts and hoists, hot and cold water systems.

The Association is administered by a managing board consisting

of engineers and representatives of architects' associations, trade associations, etc. It is assisted by a number of technical committees.

The Corporative Association for Hygiene and Safety in Building Construction was founded in 1927 by the General Office for Building and Public Works (*Office général du Bâtiment et des Travaux publics*), the National Federation of the Building and Public Works Industries (*Fédération Nationale du Bâtiment et des Travaux publics*) the group of Trade Chambers in the Building Industry (*Groupe des Chambres syndicales du Bâtiment*), the Trade Association of Public Works Contractors (*Syndicat professionnel des Entrepreneurs de Travaux publics de France*) and the General Guarantee Association of the Building and Public Works Industries.

The main object of the Association is to exercise supervision over the enforcement of the statutory safety regulations applying to building construction—for example, the regulations concerning guard-rails, fencing of openings, and first-aid stations. These duties it has assumed in order to meet the situation arising when a number of contractors are working simultaneously on a building and it is not clear which of them is responsible for observance of the safety regulations. By taking over the responsibilities of all the contractors, the Association removes all doubt in the matter and at the same time secures efficient enforcement of the safety regulations.

The Association is in the form of a joint-stock company not working for profit.

Its intervention in a particular case is based on a contract concluded with the owner of the building or the architect. The necessary installations are undertaken by the Association or sublet to contractors, but in any case are ordered by the Association's agent.

The Technical Federation of the Building and Public Works Industries was founded some 12 years ago with the primary object of conducting research work in the constructional domain. Its duties, as defined in Article 3 of its rules, include the testing and analysis of materials, the promotion of improvements and inventions of safety devices, the furnishing of technical information and the inspection of installations.

The Federation collaborates with the Safety Department of the General Guarantee Association.

According to the report prepared by the Federation of Building Trade Unions (*Fédération Nationale Confédérée des Travailleurs du Bâtiment*) for their 14th Congress held in June 1935, the building

trade unions have been working for several years to secure the appointment of "safety delegates" in the building trades. These delegates would be selected from among the workers and would exercise supervision supplementary to that of the factory inspectors in matters of hygiene and safety. The report adds that the question was considered in 1927 by the Superior Labour Council, which recommended the passage of an Act of Parliament authorising the appointment of such delegates. Bills for this purpose were introduced in the Chamber of Deputies in 1928 and 1929.

GREAT BRITAIN

In the British building trades a voluntary safety scheme has been organised by the National Federation of Building Trades Employers. The object of the scheme is to secure the systematic co-operation of employers, foremen and others in charge of building works, in an effort to reduce accident frequency and severity in building operations.

In 1933 the Federation began by setting up a Central Safety Committee and requesting its Regional Federations and Local Associations to co-operate by forming committees consisting of employers and having powers to co-opt or to consult with representatives of foremen's associations. The general duty of these committees was to stimulate the pooling of experience by employers with a view to the introduction of simple and practical methods of accident prevention. In particular, the committees were asked to keep records of the types of accidents occurring on building jobs so as to discover their relative frequency; and also to evolve practical means of conducting educative propaganda among foremen, leading hands and workers generally.

The Central Safety Committee of the National Federation drew up an accident report form to be completed quarterly by each firm and collected by the Local Association. These reports were quite independent of those required by law or by any insurance company and were designed solely to enable those concerned to profit by the pooling of experience.

The reports received by the Regional Federation during the first two quarters of 1933 were sent to the National Federation and were analysed by the Central Safety Committee. In the light of this experience, the Central Committee drew up a common system of analysis which all Regional Federations and Local Associations have been asked to adopt. The standard accident

report form is divided into three sections: a classification of accidents by causes, a classification of accidents by occupations, and a final section for recording suggestions. All suggestions recorded will be examined and as far as possible communicated to the local safety committees throughout the country. It is hoped that in this way the best practice of employers will more speedily become the general practice.

NETHERLANDS

The General Netherlands Union of Building Operatives has been actively engaged for many years in promoting safety in the building trades.

Accident statistics have been published in the trade union press and also printed on lantern slides for use in lectures. Similarly, good and bad conditions in building work have been illustrated by photographs in the press and by lantern slides. Safety has been discussed at various trade union congresses, and a special safety congress was held in Amsterdam in 1935.

Following upon a Congress held in November 1927 for the prevention of accidents in the building industry, a number of building trade unions set up a joint Committee for the same purpose.

The Committee decided in the first place to issue a safety poster with the object of exhorting building workers to be prudent and also of showing them that their own organisations were taking part in the safety movement. A competition was organised and the best design for the poster was printed and distributed by the unions throughout the country.

The building trade unions have recently co-operated in the preparation of a booklet dealing with the safety regulations applying to building.

POLAND

The Institute of Social Problems (*Instytut Spraw Społecznych*) which has played a prominent part in all fields of industrial safety, organised a competition in 1935 for designs of a completely safe system of scaffolding. The jury consisted of officials from the Ministry of Social Assistance, the Ministry of the Interior, the Federation of Polish Architects, the Federation of Building Engineers, and the Master Builders' Association, under the chairmanship

of the Assistant Director of the Institute. Four prizes were awarded, and the Institute bought the two best designs.

SWITZERLAND

In 1927, with the object of checking the increase in building accidents the Swiss Master Builders' Association (*Société Suisse des Entrepreneurs*), acting in agreement with the National Accident Insurance Institute, set up an Advisory Office for Accident Prevention. The Office is under the direct authority of the Central Executive of the Swiss Master Builders' Association and is aided by a Committee of five members, which meets three or four times a year. The duties of the office are to study safety matters and to propose measures for the prevention of accidents. Any member of the Swiss Master Builders' Association may have recourse to its services free of charge.

Its officials are empowered to inspect buildings under construction, to draw attention to dangers, to see that the necessary precautions are taken and to report obstructive employers to the Swiss National Accident Insurance Institute.

In 1933 the Office carried out 1,007 visits of inspection on buildings, and on behalf of the National Insurance Institute investigated 26 serious accidents.

The Association also publishes articles on safety matters in its weekly journals, analyses accident statistics, arranges for safety talks to building workers, investigates accidents and collaborates generally with the National Accident Insurance Institute and the building inspection authorities.

CZECHOSLOVAKIA

A certain amount of safety propaganda is carried on by the building operatives' trade union (*Verband der Arbeiter in der Bau-, Stein- und Keramindustrie i.d. Č.S.R.*). Advantage is taken of Union meetings to recall the provisions of the safety regulations, and for this purpose the Union has adopted the slogan "Wages are higher than accident pensions, so heed the safety rules." The Union's newspaper has also published photographs of good and bad scaffolds.

PART V

CONCLUSIONS

I

The statistics reproduced in Part I give an impressive picture of the grave accident risks to which building workers are exposed. In all the countries for which statistics are given in this report and comparisons between industries are possible, the figures show that in the building industry both the frequency and severity rates of accidents are far higher than in most other industries; in general the accident figures for building seem to be about double the average for all industries taken together.¹

Only very few industries—mining, shipping and in some cases lumbering—show higher accident figures than building, but it should be remembered that these are precisely the industries which have to contend with natural phenomena such as explosions of gas, falls of earth and bad weather which are extremely difficult or impossible to control, and in such industries even the most up-to-date safety devices and measures are often of little or no avail.

If we turn to the causes of accidents in the building industry—a matter that is of considerable importance for the purpose of the present report—we shall again find a large measure of agreement between the statistics of the different countries. It will be seen that in nearly all countries more than a half of *all* accidents to building workers come under the heads of “falls” (of persons or objects), “transport” and “handling of objects”. Numerically

¹ This conclusion is confirmed by investigations in other countries. In Italy, for example, it has been found that accident frequency in the building industry is double that in any other industry except mining. (FRANCESCO MASSARELLI: *L'importanza della prevenzione degli infortuni nei cantieri di costruzione*. Trieste, 1935.)

most important are "falls", which alone account for about a third of *all reported accidents* in the building industry.

The predominance of these three groups of causes—especially "falls"—is brought out more clearly still by an examination of the figures of fatal and other serious accidents. These figures prove that no less than from two-thirds to three-quarters (and sometimes more) of the *fatal* accidents are invariably accounted for by the three causes in question. More than a half of these accidents are due to "falls" alone. The position is much the same as regards the other serious accidents; on this point it will suffice to refer to the French statistics (Part I, table XII) which show that 38 per cent. of the accidents resulting in permanent invalidity and 39 per cent. of those resulting in temporary invalidity were due to "falls".

In this connection it may also be of some interest to quote from Swiss experience. In 1931-1932 about a half of all accidents in Switzerland classified as "falls of persons" were falls from scaffolds, platforms, ladders and stairs; no fewer than 2,900 accidents were caused by scaffolds, which were responsible for 16.3 per cent. of the aggregate accident compensation costs.

II

In all countries the building industry is distinguished from ordinary industries by various peculiarities that make the application and enforcement of safety regulations matters of some difficulty.

In ordinary industrial undertakings, the workers usually have definite, permanent and roomy workplaces; the machines and other heavy equipment are fixed in position and the safety devices once installed can as a rule be left in place for some long time to serve their purpose.

The position is very different in the constructional industry, and especially building construction. Building and site are at the same time work and workplace. Workplaces are mostly at a considerable height and are continuously changing throughout the building operations. The equipment, and in particular the scaffolds, must not only be erected anew on every fresh site and provided with the necessary safety devices; it must also be completed or raised at comparatively frequent intervals as the building advances and consequently fresh precautions have repeatedly to be taken.

If, then, it must be admitted that in the building industry various sources of danger are present which in ordinary industries enter into consideration only in a small measure or not at all, it must also be admitted that, in contrast to mining and the other industries mentioned as having particularly high accident rates, building is an industry in which the present state of technical knowledge would undoubtedly seem to enable its peculiar dangers to be effectively overcome.

Bearing in mind the general principles laid down in the *Recommendation concerning the Prevention of Industrial Accidents* adopted by the Twelfth Session of the International Labour Conference, the means to this end must be said to consist not only in proper and thorough safety education of building workers and closer co-operation of all the parties concerned in the spirit of the Safety-first movement, but also, and indeed primarily, in better *building safety legislation and more effective supervision of building operations*.

III

The legislation on safety in building operations varies widely from country to country as regards both nature and scope.

Some countries possess special building safety regulations with more or less detailed provisions governing, for example, the erection and protection of scaffolding, cranes, ladders, etc., while in others there are only quite general regulations on the subject, or even none at all. Equally diverse is the scope of safety regulations in different countries: in some they apply generally, in others only to buildings of a certain size, or only to buildings on the erection of which special machinery is used or a certain number of workers are employed. Further, it sometimes happens that buildings in large towns are subject to different regulations from those in small towns or in the country.

Although the differences in building safety regulations are partly due to differences in the building and working methods to be found from country to country, they are certainly not to be wholly accounted for in this manner, and there would seem to be no insuperable difficulties in the way of agreement upon certain general technical principles which could be taken as a guide in the framing of new, or the completion of existing, safety regulations in the various countries.

Of particular importance would be the elaboration of such guiding principles or model regulations for scaffolds and hoisting appliances. The view expressed by the Swiss Accident Insurance Institute that the erection of adequate scaffolding and constant supervision after its erection are the first essentials for the prevention of building accidents ¹ will hardly be contested by any expert to-day; indeed its soundness is amply attested by the fact that in the building industry accidents due to falls of persons and objects take first place both for frequency and severity.

In this connection it must also be noted that scaffolds and hoisting appliances are precisely the matters in which certain basic principles are more or less clearly discernible in national legislation; and to co-ordinate and fix these principles as international standards would appear to be a perfectly justifiable undertaking.

With regard to scaffolding and similar equipment, it might be laid down, for example, that every workman exposed to the risk of falling from a height should be provided, as far as possible, with a sufficiently large workplace, constructed of suitable material and in a proper manner, and so protected by hand-rails and toe-boards that the risk of falling is obviated as far as circumstances allow. Further, in application of this general principle, model regulations could be framed, for the erection, use, etc., of the various types of scaffolding.

For hoisting appliances and their use general rules might be laid down concerning the erection and testing of the appliances and protection against the fall of materials; provision should also be made for protecting the stand of workers handling the loads, and securing the appliances against overloading.

Rules could also be drawn up for the guarding of wall and floor openings in buildings under construction, for the safety of ladders, etc., etc., and such rules might be written into national regulations wherever possible.

It should however be made clear that *complete uniformity* seems attainable only in the case of certain provisions of a *general* character, to the exclusion of *detailed technical requirements*.² This circumstance, however, is of no great importance; the main thing

¹ See p. 21

² On this point it may be mentioned by way of example that in the various countries differences will be found not only in the types of scaffolds but also in the nature and dimensions of the materials of which they are made. Consequently the fixing of a specific uniform spacing for putlogs or uniform dimensions of guard railings would be an extremely difficult matter.

is for as many countries as possible to issue regulations in which they would embody the guiding principles with the necessary adaptations, and with due regard to any special conditions in their building industry, so that the highest possible degree of safety would be attained.

For safety purposes it is of far more importance than complete uniformity in the wording of technical regulations that there should be uniformity in the *scope* of the regulations as a whole, in the sense that they would apply to *all* buildings. It is, in fact, not apparent why safety legislation should draw a distinction between large and small buildings, buildings with and without power-driven machinery, or urban and rural buildings: a man who falls from the second storey of a rural building devoid of machinery is in most cases just as likely to be killed as a man who falls from the sixth or twelfth storey of a city skyscraper.

Lastly, the safety regulations should also deal with roof work, and the repair and renovation of existing buildings and be fully applicable to such work. This is all the more important since experience has shown that these are classes of work in which the safety precautions are often neglected and hence the accident risk unnecessarily increased.

A draft of a *Model Safety Code for Scaffolds and Hoisting Appliances used in the Building Industry* is given at the end of this chapter of this report. This draft embodies the conclusions reached after exhaustive discussion by the Correspondence Committee on Accident Prevention¹ and is modelled as closely as possible on existing regulations in the various countries. It would therefore furnish a suitable basis for international regulations.

It is, however, necessary to consider not only the substance of the international regulations but also the form to be given to them. It is true that the final decision on the question of form will not be taken until the Session of the Conference in 1937 and that in the meantime the Governments must first be consulted, but it may nevertheless be useful to indicate at once some of the considerations involved.

In view of the great importance that must be attached to the framing and enforcement of suitable safety rules for building operations, it would certainly be preferable that any international regulations should take the form of a Draft Convention rather

¹ See Introduction to this report.

than of a Recommendation, since it is clearly desirable that the States should undertake definite contractual obligations and be required to furnish regularly information as to the way in which they are giving effect to the safety rules agreed upon internationally. The international regulations might therefore take the form of a Model Code approved by the Conference and incorporated as a schedule in a Draft Convention. It must, however, be recognised that the provisions which the Conference may decide to include in this Model Code may not all be of quite the same character, and if this should prove to be the case it may be necessary to contemplate the adoption of a Draft Convention cast in a slightly different form from those hitherto adopted by the Conference.

If the technical problems involved are to be adequately treated, the Model Safety Code adopted internationally must include a certain amount of detail. If it is to serve its purpose, it must not only express the common features of the best national regulations as clearly and as fully as possible; it must also make provision for cases that occur in some countries and are unknown in others. The Code must, for instance, contain provisions dealing with almost all types of scaffolding although some of these types may not be employed in certain countries. Moreover, in addition to general provisions strictly enforceable everywhere it will probably be found desirable to include detailed technical provisions, the strict letter of which it might not be possible to follow in every country but the spirit of which should be observed in all. It is, of course, as yet impossible to forecast the extent to which the Conference may ultimately decide to enter into matters of detail in the Model Safety Code; but there would seem to be considerable advantage in including in the Code, for the sake of completeness, at any rate a certain amount of detail, which might even be of a purely technical character such as the specification of the nature and dimensions of materials to be used.

It would clearly be unwise to make the obligations imposed by the Draft Convention upon States ratifying it equally stringent in respect of all the provisions of the Model Safety Code if the provisions of the Code are not of a uniform character. It might be sufficient in certain cases if States, while not binding themselves to enforce strictly certain provisions of the Code, nevertheless undertook to take those provisions into careful consideration as the basis for their legislation and practice and to apply them as far as was considered practicable in the conditions prevailing in the building industry in their respective territories. Even in respect

of these model rather than mandatory provisions, however, it would still be desirable that every State ratifying the Convention should furnish, in its annual report on the measures taken to give effect to the Convention required under Article 22 of the Constitution (Article 408 of the Treaty of Versailles), information as to whether, and if so to what extent, it had given effect to these provisions.

There would not appear to be any difficulty in framing a Draft Convention on these lines. Such a Draft Convention would first impose on the ratifying States an obligation to enforce such provisions of the Model Code as the Conference might decide to specify as being mandatory. Secondly, it would require that the ratifying States should take into consideration and apply as far as they considered practicable any provisions contained in the Model Code which the Conference might decide to specify as not being strictly mandatory. Thirdly, it would impose on the ratifying States an obligation to furnish to the International Labour Office the usual annual reports upon the measures taken to give effect to the Convention in respect of both the mandatory and the non-mandatory provisions of the Model Safety Code. Finally, the Code itself would be given as an annex to the Convention.

It may perhaps be as well to touch upon a further question, though this also does not call for any immediate decision by the Conference. If the Safety Code is to maintain its usefulness as a model its provisions must keep abreast of the developments occurring as knowledge extends and practice is perfected, now in one country and now in another, and it will therefore be necessary for the Code to be revised from time to time. It has been considered that it would be an advantage if revision could be effected, at any rate in respect of the non-mandatory provisions of the Code, by some procedure which would be simpler and more expeditious than the usual procedure for the revision of Conventions. The suggestion has been made that it might, for example, be possible for proposals for amendment to be submitted to an expert committee, such as the Correspondence Committee on Accident Prevention, for consideration with a view to the framing of a suitable revised text. The text so framed would then be submitted to the Governing Body and ultimately to the Conference with a view to approval by the Conference in substitution for the text appearing in the annex to the Convention. Whether any such procedure would be necessary or desirable cannot, of course, be foreseen at the present stage. But since revision will undoubtedly be necessary the Conference may

think it well to limit the duration of the Convention to a period of say, five years. If it is then found necessary to proceed to revision, consideration could be given at that stage to the possibility of devising a simple and expeditious procedure for further revision in subsequent years.

To sum up, therefore, the adoption of international regulations in respect of safety provisions for scaffolds and hoisting appliances in the building industry appears to be both possible and necessary. It would be desirable for such regulations to take the form of a Draft Convention in which the complete text of a Model Safety Code could be given and in which also a distinction could be made, if necessary, between provisions of the Code which were strictly mandatory and those which were to be regarded as models to be followed in the spirit but not necessarily in the letter. As will be seen from the list of points for the consultation of Governments given at the end of this report, the Office suggests that Governments should be asked to give their views as to the desirability of adopting international regulations in the form suggested above. At the same time provision is made in the list of points so as to give Governments an opportunity to express their views on the question of form so that any other possible alternatives may be considered when the question comes up again before the Conference in 1937.

IV

By reason of the previously mentioned conditions prevailing on buildings under construction, comprehensive and effective supervision of the enforcement of safety regulations here is doubtless more difficult than at workplaces in other industries. On the other hand it must be recognised that on buildings such supervision is usually at least as necessary as in ordinary industries.

It would therefore be highly desirable for all countries to take steps to ensure that supervision of the enforcement of safety legislation in building operations is as effective as possible. Uniformity of legislation in this field is doubtless unattainable; it will have been seen from Part III of the present report that both the organisation and the powers of building inspection authorities are too diverse for this.

Accordingly, as far as the inspection of building operations is concerned, it will probably be best for the Conference to confine

itself to a Recommendation. Having regard to the high accident rates in the building industry and the great part that effective inspection plays in accident prevention, the Recommendation should require States to take all appropriate steps for the improvement of labour inspection in this industry.

In the same Recommendation, or in another, reference might be made to the great value of co-operation between employers and workers in safety matters, and the Member States might be invited to promote and further this co-operation by all the means in their power. Such an invitation is contained in the Recommendation of 1929 on the Prevention of Industrial Accidents (No. 31) and the question is also dealt with in the Recommendation of 1923 on Factory Inspection (No. 20).

In the building industry, both the special working conditions obtaining and the many difficulties in the way of effective supervision of building operations by inspectors would seem to render the appointment of "safety delegates" from among the ranks of the workers particularly desirable. Another useful and desirable measure would be the establishment of special safety organisations by building contractors, somewhat on the lines of the one set up by the Swiss Master Builders' Association (*Schweizerischer Bau-meister-Verband* — *Société Suisse des Entrepreneurs*).

Lastly, it should be mentioned that the owner and the architect could also help to promote safety. If for instance the owner would allow sufficient time for the erection of his building, the contractor would frequently be able either to vary the sequence of certain operations or to take additional precautions in carrying them out, and hence to reduce the accident risk. Similarly the architect could render substantial aid in the prevention of accidents, especially in repair and renovation work, by making allowance in his plans and estimates for the work of this kind that will have to be done on the building from time to time after its completion, and providing the necessary attachments for scaffolds, etc. These two points might well be included in any Recommendation that the Conference may adopt.

CONSULTATION OF GOVERNMENTS

After the foregoing survey of the various aspects of the question, it remains only to fix as completely as possible, in accordance with Article 6 of the Standing Orders of the Conference, the points upon which the Governments might be consulted. In the light of the conclusions set out above, it is suggested that the Conference might instruct the Office to consult the Governments on the points in the following list:

A. — SAFETY CODE

1. SCOPE OF THE REGULATIONS

- (i) Regulations applicable:
 - (a) to the construction of all types of buildings;
 - (b) only to the construction of buildings of a certain height (e.g. more than one storey);
 - (c) only to the construction of buildings on which a certain minimum number of workers (e.g. five) are employed;
 - (d) to repair, maintenance and demolition work, etc., on existing buildings.
- (ii) Desirability of empowering the competent authority in each country to grant exemptions from the regulations in certain cases.

2. SUBSTANCE OF THE CODE

Desirability of basing the proposed international Model Safety Code upon the text drawn up by the Correspondence Committee on Accident Prevention (see pp. 347 to 364).

3. MEASURES FOR ENFORCEMENT AND SUPERVISION

- (i) Desirability of imposing certain obligations on employers:
 - (a) posting up of regulations;
 - (b) issuing of special instructions to workmen employed on particularly dangerous jobs;
 - (c) special supervision of such jobs;
 - (d) any other measures.
- (ii) Desirability of imposing on States an obligation to furnish information in their annual reports on the measures taken to give effect to all the provisions of the Code, including any which may be non-mandatory.

4. FORM OF THE REGULATIONS

- (i) Draft Convention incorporating a Model Safety Code ;
- (ii) Any other proposal.

B. — INSPECTION

Recommendations concerning Labour Inspection in the Building Industry.

C. — CO-OPERATION IN ACCIDENT PREVENTION

Recommendation concerning co-operation between employers, workers and others concerned in the prevention of accidents in the building industry.

Draft Model Safety Code for Scaffolds and Hoisting Appliances Used in the Building Industry

PART I

SCAFFOLDS

1. — *General Rules*

(1) Suitable scaffolding shall be provided for workmen for all work that cannot be safely done from a ladder or by other means. Necessity for scaffolding.

(2) Every scaffold shall be constructed under the direction of a competent and responsible person, and as far as possible by skilled and experienced workers. Qualifications of scaffold erectors.

(3) All scaffolding and appliances connected therewith shall be of sound material and strong enough to support the loads and strains to which they will be subjected. Quality of materials.

In particular the wooden parts used for scaffolds, gangways, runs and ladders shall be of good quality, shall have long fibres and shall be in perfect condition; they shall not be painted or in any other way treated so that defects cannot easily be seen.

Round timber used for scaffolding shall have the bark completely stripped off. Boards and planks shall be protected against splitting.

Material used for metal scaffolds shall have no cracks and shall be free from corrosion or other defects.

Cast iron nails shall not be used.

(4) On each occasion before erection, scaffold parts shall be examined by experienced persons and shall not be used unless in every respect they possess the qualities required for their purpose. If any part is found defective it shall be repaired, or if not capable of repair, shall not be used as scaffold plant. Inspection of materials.

On each occasion before use ropes shall be carefully examined by qualified persons, and any rope that has been in contact with acids or other corrosive substances shall not be used.

Storage of
materials.

(5) All materials used in the construction of scaffolds shall be stored under good conditions.

2. — *Supply and Use of Material*

Sufficient material shall be provided for, and shall be used in the construction of scaffolds, and when in place no part shall be removed until it is no longer required for working purposes, stability or safety.

3. — *Pole and Gabbard Scaffolds*

Uprights.

(1) Pole standards and the legs of gabbard scaffolds shall be vertical—or if only one row of uprights is used, shall be slightly inclined to the building—and fixed sufficiently close together to secure the stability of the scaffolding having regard to all the circumstances.

The stability of pole standards shall be secured by letting the pole 60 cm. or more into the ground, according to the nature of the soil, by properly placing the pole on a plank in such a way that slipping is securely prevented, or in any other sufficient way.

When two scaffolds meet at a corner of a building under construction, a pole standard shall be placed at the corner on the outside of the scaffolds.

Ledgers.

(2) Ledgers shall be practically level. They shall be securely fastened to the uprights by bolts, dogs, ropes or other efficient means. The ends of two consecutive ledgers at the same level shall be securely joined together.

Putlogs.

(3) Putlogs shall be straight and securely fastened to the ledgers.

Putlogs which have one end supported by a wall shall have at that end a plane supporting surface at least 10 cm. deep.

The distance between two consecutive putlogs on which a platform rests shall be fixed with due regard to the anticipated load and the nature of the platform flooring. This distance shall in no case exceed 1 m. with planks 30 mm. thick, 1.50 m. with planks 40 mm. thick, and 2 m. with planks 50 mm. thick.

4. — *Ladder Scaffolds*

Ladder scaffolds shall only be used for work requiring little material (renovation, painting and the like).

The ladders serving as the uprights of these scaffolds shall be of adequate strength. They shall be let into the ground

to a depth of at least 50 cm. or placed on sole plates or boards so that the two uprights of each ladder rest evenly on the base. In the latter case the feet of the ladders shall be suitably fastened to prevent them from slipping.

If a ladder is used to extend another, the two shall overlap at least 1.50 m. and shall be securely fastened together.

5. — *Stability of Pole, Gabbard and Ladder Scaffolds*

(1) Every scaffold shall be sufficiently and properly braced; in every case the scaffold—unless it is an independent scaffold—shall be rigidly connected with the building at suitable vertical and horizontal distances.

Bracing.
Anchoring to
building.

(2) If the scaffold is an independent scaffold, at least one-third of the putlogs used for supporting any working platform more than 3.5 m. above the ground or floor shall remain in position until the scaffolding is finally removed; these putlogs shall remain securely fastened to the ledgers.

Independent
scaffolds.

(3) In general, all structures and appliances used as supports for working platforms shall be of sound construction, shall have a firm footing and shall be suitably struted and braced to make them stable.

Supports
for working
platforms.

Loose bricks, drain pipes, chimney pots or other unsuitable material shall not be used for the construction of scaffolds.

6. — *Cantilever or Jib Scaffolding*

Cantilever or jib scaffolding shall be securely fixed and anchored from the inside. The outriggers shall be of adequate length and cross-section to ensure its solidity and stability. The scaffolding shall be properly braced and supported.

Only solid parts of the building shall be used as supports for scaffold parts.

If working platforms rest on wooden bearers let into the wall the bearers shall go right through the wall and be securely fastened.

7. — *Bracket Scaffolds*

No figure or bracket scaffold supported or held by dogs or spikes driven into the wall shall be used.

8. — *Heavy Suspended Scaffolds*

Heavy suspended scaffolds shall comply with the following regulations:

(1) Outriggers shall be installed at right angles to the building face and carefully spaced to suit the deck irons.

Outriggers.

The overhang of the outriggers from the building shall be such that when practicable the platform is fixed to hang 10 cm. from the building face.

Anchorage. (2) Anchor bolts shall be properly tightened and shall securely tie down the outrigger to the framework.

The use of counterweights (bags of cement, piles of bricks, etc.) shall be prohibited as a means of securing outriggers of these scaffolds.

Stop bolts. (3) Stop bolts shall be placed at the end of each outrigger.

Shackles and deck irons. (4) The shackles serving to fasten the cables to the outriggers shall be placed directly over the drum centres to get a straight lead. The eye of the cable shall be placed in the centre of the bent shackle bolt.

The deck irons supporting the platforms shall be suitably fastened so as to prevent slipping and to hold the machines. The fish plates joining the deck irons shall be properly bolted.

Cables. (5) Cables, when new, shall have a safety factor of at least 10, based on the maximum load that the platform may be called upon to bear.

The length of the cables shall be such that at the lowest position there are at least two turns of rope on each drum.

9. — *Light Suspended Scaffolds*

Light suspended scaffolds shall comply with the following regulations:

Outriggers. (1) The outriggers shall be of adequate length and cross section and shall be suitably installed and supported.

Anchorage. (2) The inside ends of the outriggers shall be firmly secured. When the outriggers have to be placed on a flat roof the bags of ballast shall be securely lashed to the roof.

Platform. (3) The maximum length of the platform shall be 8 m.

Suspension ropes. (4) The platform shall hang on at least 3 ropes, not more than 3 m. apart. The middle rope shall at no time be tauter than the other two.

Pulley blocks. (5) The pulley blocks shall be fastened to the platforms by stout iron bands, properly secured and continued round the sides and bottom of the platform, with eyes in the iron to receive the ropes.

Maintenance of distance between the platform and the wall. (6) Suspended scaffolds on which the workers sit to work shall be provided with devices to keep the platform at a distance of at least 30 cm. from the wall and to prevent the workers from knocking their knees against the wall if the scaffold swings.

10. — *Other Suspended Scaffolds*

When a skip, large basket, or similar equipment is used as a suspended scaffold, it shall be supported by cables having a safety factor of at least 10, based on the total load including the dead weight.

Such equipment shall be at least 75 cm. deep and shall be carried by two strong iron bands properly fastened and continued round the sides and bottom, with eyes in the iron to receive the ropes.

Provided that the use of such equipment shall only be allowed in exceptional circumstances and under the supervision of a responsible person.

11. — *Transport and Storage of Material on Scaffolds: Distribution of the Load*

In transferring material on a scaffold, or from the ground or a floor to the scaffold, care shall be taken to handle gently so that no sudden shock is transmitted.

The load on the scaffold shall also be evenly distributed, so as to avoid any dangerous disturbance of the equilibrium.

During the use of a scaffold care shall constantly be taken that it remains in good condition, that it is not overloaded and that materials are not improperly stored upon it.

12. — *Installation of Lifting Gear on Scaffolds*

When lifting gear is to be used on a scaffold, the parts of the scaffold shall be carefully inspected and, if need be, strengthened. Any movement of the putlogs shall be prevented and the uprights shall be rigidly connected to a solid part of the building at the place where the lifting gear is erected.

13. — *Periodic Inspection of Scaffolds*

Scaffolds shall be inspected by a competent person once a week, as well as after every spell of bad weather and every interruption in the work.

14. — *Use of Scaffolds constructed by Other Contractors*

Where a scaffold has not been erected by or under the superintendence of the employer whose workmen are to use it, the said employer, before allowing work to proceed thereon, shall satisfy himself that the scaffolding is in a stable condition, that the materials used in its construction are sound, and that the required safeguards are in position.

He shall further see that the scaffold is kept in good condition for the whole period of the work that he carries out.

15. — *Working Platforms*

Flooring. (1) Every working platform which is more than 2 m. above the ground or floor shall be closely boarded or planked. Provided that on inside scaffolds, where the work so requires, there may be a gap between the planks of the platform; in this case the planks shall be fixed so as to prevent the gap from widening.

Width of platforms. (2) The width of the platform shall be as follows:
(a) At least 40 cm. if used as a footing only and not for the deposit of any material;
(b) At least 80 cm. if used for the deposit of material;
(c) At least 110 cm. if used for the support of any higher platform.

Provided that a working platform upon which stone is dressed or roughly shaped shall be at least 130 cm. wide and, if used for the support of any higher platform, shall be at least 150 cm. wide.

The maximum width of a platform supported on putlogs shall as a rule not exceed 160 cm.

Extreme position of platform. (3) Every working platform shall, if part of a pole or gabbard scaffold, be at least 1 m. below the top of the standards.

Planks and boards. (4) The thickness of boards or planks which form part of a working platform or which are used as toe-boards shall be proportionate to the distance between the putlogs, but in no case less than 2.5 cm.; and their width shall be not less than 20 cm.

Projection. (5) No board or plank which forms part of a working platform shall project beyond its end support to a distance exceeding four times the thickness of the board or plank.

Overlapping. Boards or planks shall not overlap one another unless precautions, such as the provision of bevelled pieces, are taken to reduce the risk of tripping to a minimum and to facilitate the movement of barrows.

Support. (6) Every board or plank which forms part of a working platform shall rest on at least three supports, unless the distance between the putlogs or the thickness of the board or plank is such as to exclude all risk of tripping or undue sagging.

Fixing of boards and planks. (7) Platforms shall be so made that the boards or planks cannot be accidentally displaced.

Length of platforms. (8) Wherever possible a platform shall extend at least 60 cm. beyond the end of the wall of the building.

(9) Every working platform which is more than 2 m. above the ground or floor shall be provided on the side away from the wall and at each end with a suitable guard-rail, having a cross section of at least 30 cm.², at 1 m. above the platform, and with toe-boards at least 20 cm. high.

Guard-rail
and
toe-boards.

The toe-board shall be as close as possible to the platform so as to prevent the fall of materials and tools.

A suitable guard-rail and toe-boards shall where practicable also be provided on the side towards the wall near window and other openings in the wall.

The guard-rail and toe-boards used on a scaffold platform shall be placed on the inside of the uprights.

(10) The platforms of suspended scaffolds shall be provided on all sides with guard-rails and toe-boards.

Platforms
of suspended
scaffolds.

Provided that on the side facing the wall the guard-rail need not be at a height of more than 70 cm. if the work does not allow of a greater height.

The guard-rail and toe-boards shall not be compulsory on the side facing the wall if the workers sit on the platform to work, but in this case the platform shall be provided with cables, ropes or chains affording the workers a firm handhold and capable of holding any worker who should slip.

(11) The space between the wall and the platform shall be as small as practicably possible, except where workmen sit on the platform during their work, in which case the space shall not exceed 45 cm.

Space
between the
platform and
the wall.

16. — *Gangways, Runs, Stairs*

(1) Every gangway or run shall be at least 40 cm. wide when any part is more than 1.5 m. above the ground or floor; the maximum slope shall be 70 cm. per metre. All planks forming a gangway or run shall be so fixed and supported as to prevent undue or unequal sagging.

Width and
slope of
gangways.

When the slope renders additional foothold necessary, and in every case where the slope is more than 25 cm. per metre, proper stepping laths, the full width of the gangway, shall be placed at suitable intervals not exceeding 30 cm., provided that the stepping laths may be interrupted over a breadth of 10 cm. to facilitate the movement of barrows.

(2) Stairs shall be provided with guard-rails throughout their length. Gangways, and stairs over 1.5 m. above the ground or floor shall be provided with guard-rails and toe-boards.

Guard-rails
and
toe-boards.

The guard-rails and toe-boards shall satisfy the requirements of Section 15 (9).

17. — *General Rules concerning Platforms, Gangways, Runs and Stairs*

(1) Every platform, gangway, run or staircase shall be kept free from any unnecessary obstruction, rubbish, etc. If necessary suitable precautions shall be taken to prevent any platform, gangway, run or staircase from becoming slippery.

(2) No part of a working platform, run or gangway shall be supported by loose bricks, drain pipes, chimney pots or other unsuitable material.

No working platform, run or gangway shall be supported by an eaves gutter, a balcony or its coping, a lightning-conductor or other unsuitable parts of a building.

(3) No working platform, gangway or run shall be used for working upon until its construction is completed according to these regulations and the prescribed safeguards properly fixed.

18. — *Trestles*

No trestle scaffold of more than two tiers or exceeding a height of 3 m. from the ground or floor or erected on the platform of a suspended scaffold shall be used.

The width of a trestle scaffold erected on a platform shall be such as to leave sufficient free space on the platform for the transport of materials.

19. — *Ladders*

Length and
fixing of
ladders.

(1) Every ladder used as a means of communication shall rise at least 1 m. above the landing place, shall not stand on loose bricks or other loose packing, but shall have a level and firm footing. It shall be securely fixed so that it cannot move from its top rest; undue sagging shall be prevented.

Every ladder which cannot be secured at the top shall be securely fastened at the base or if that is impossible also, shall have a man stationed at the foot to prevent slipping.

Ladders
between
floors.

(2) The ladders connecting the different floors shall be staggered and a protective landing with the smallest possible opening shall be provided at each floor. Such ladders shall not be used for the transport of loads exceeding 50 kg.

Prohibition
of use of
certain
ladders.

(3) A ladder having a missing or defective rung shall not be used.

No ladder made of sawn timber shall be used unless it is of adequate strength and the rungs are securely notched in or housed.

Roofers' and painters' ladders shall not be used by workmen in other trades.

20. — *Fencing of Openings*

Every opening left in a floor of a building or in a working-platform for an elevator-shaft or stairway, or for the hoisting of material or for access by workmen or for any other purpose shall be provided with a suitable guard-rail and toe-board or with other efficient means to prevent the fall of persons or articles into the opening.

The same shall apply to every opening in a wall, if less than 1 m. from a floor.

This fencing shall remain until it becomes necessary to remove it in order to complete the permanent enclosure.

Provided that the said guard-rails, toe-boards or other safeguards may be removed for the time and to the extent required to allow the access of persons or the transport or shifting of materials.

21. — *Roof Work*

(1) No person shall be employed on a roof on which there is a risk of falling, by reason of the pitch, the nature of the surface or the state of the weather, unless efficient precautions are taken to prevent the fall of persons or materials.

On glass roofs, or roofs covered with fragile materials, special precautions shall be taken to prevent the workers from inadvertently stepping on them and to facilitate the safe carrying out of repairs.

(2) No person shall be employed on extensive work at the outside of any roof which has a pitch of over 34° (2:3) or is slippery unless at least the following facilities are provided thereon:

General rules.

Work on steep or slippery roofs.

(a) A suitable working platform, securely supported and of a width of not less than 40 cm., and

(b) Suitable and sufficient ladders, duck ladders, or crawling boards properly secured.

Further only experienced workmen who are physically and psychologically suitable shall be employed on such work.

(3) When it is impossible to use the safeguards mentioned in paragraph 2 above safety belts with ropes enabling the wearers to lash themselves to a solid structure shall be supplied to the workers and used by them.

Safety belts

22. — *Miscellaneous Rules*

(1) Any part of the premises in which any person is employed or through which any person may pass shall be covered in such a manner as to protect such persons from being struck by any falling materials, tools or other articles.

Protection of workplaces and passageways.

If it is impossible to cover any workplace or passageway, efficient precautions shall be taken to prevent falls of objects from any height exceeding 3.5 m.

Scaffold materials, tools, or other objects shall not be thrown down, but be properly lowered.

Lighting of workplaces.

(2) Every working-place and approach thereto shall be efficiently lighted.

Protection of electric wiring and equipment.

(3) During all construction, repair, painting or demolition of buildings, all necessary precautions shall be taken to prevent the workers from coming into contact with electric wires or equipment, including low-tension wires and equipment.

(4) Protruding nails shall be removed from all materials used in the construction of scaffolding or falsework.

PART II

HOISTING APPLIANCES

23. — *General Rules*

Construction, maintenance and periodical examination of the appliances.

(1) The working gear and the anchoring and fixing appliances of every crane, crab and winch and of all other hoisting machines and tackle shall

- (a) Be of good mechanical construction, sound material, adequate strength and substance and free from defect;
- (b) Be kept in good repair and in good working order;
- (c) As far as the construction permits be examined in position at least once in every week by the driver or other competent person.

Indication of maximum safe load.

(2) Every crab, winch and pulley block used in the hoisting or lowering of any load, and every derrick pole or mast used in the hoisting or lowering of any load weighing 1,000 kg. or more, shall have the maximum safe working load plainly marked upon it.

Every crane shall have the safe working load, or, in the case of a crane fitted with a derricking jib, the safe working loads at various radii of the jib plainly marked upon it.

Overloading the appliances prohibited.

(3) A crane, crab, winch or any other hoisting appliance, or any part of such appliance shall not be loaded beyond the safe working load.

Provided that for the purpose of making tests of a crane or other hoisting appliance or gear the safe working load may be exceeded by such amount as the competent person appointed to carry out the tests may authorise.

(4) During hoisting operations effective precautions shall be taken to prevent any person from standing or passing under the load.

Passing
under loads,
and leaving
loads
suspended
prohibited.

No load shall be left suspended from a hoisting appliance unless there is a competent person actually in charge whilst the load is so suspended.

(5) No person under 18 years of age shall be employed to handle hoisting appliances or to give signals to the operator.

Age and
qualifications
of operators
of hoisting
appliances.

Every crane driver or hoisting-appliance operator shall be properly qualified.

(6) When any hoisting or lowering is performed by means of a crane and the crane driver or person operating the crane is unable to see the load in all its positions, one or more look-out or signal men shall be stationed so as to see the load throughout its travel and give the necessary signals to the crane driver or person operating the crane.

Signals.

There shall be a distinctive signal for each operation to be performed, and the signal shall be such that the person to whom it is given shall be able to hear or see it easily. Where a sound signal is used, it shall be made by an efficient device.

Every signal wire shall be adequately protected from accidental interference.

(7) Motors, gearing, transmissions, electric wiring and other dangerous parts of hoisting appliances shall be provided with efficient safeguards. If the safeguards have to be removed, they shall be replaced as soon as possible by the persons removing them.

Protection
of dangerous
parts of
appliances.

(8) Where reasonably practicable, the driver's cab on every crane or other hoisting appliance shall, before the crane or appliance is put into general use, be completely erected, or other adequate provision made for the protection of the driver from the weather. During cold weather the cabin of each power-driven crane or other hoisting appliance in use shall, where reasonably practicable, be adequately heated by suitable means.

Driver's cab.

24. — Winches, Crabs and Pulleys

(1) Every part of the framework of every crab or winch, including the bearers, shall be of metal.

Winch
frame-work.

(2) When wire ropes are used, the diameter of the pulleys or drums shall not be less than 400 times the diameter of the wires in the rope. For the purposes of the present requirement no account shall be taken of the core of the rope.

Drums and
pulleys.

When winch drums are grooved, the grooves shall be such that the different turns of rope are not squeezed together.

The drums shall be provided with flanges that prevent the rope from slipping off the drum.

Brakes and
other stop-
ping devices.

(3) (a) Every crane, crab and winch shall be provided with an efficient brake or brakes and with any other safety device required to prevent the fall of the load when suspended.

(b) The lever controlling the link motion reversing gear of every steam crane shall be provided with a suitable spring-lock arrangement.

25. — *Suspension and Attachment*

Cables, ropes
and chains.

(1) (a) All cables or ropes used on hoisting appliances for raising or lowering materials shall be long enough to leave at least two turns on the drum when they are fully unwound.

(b) No rope shall be used over a grooved drum or pulley if its diameter exceeds the pitch of the drum grooves or the width of the pulley groove.

(c) Wire ropes shall be such as to have a safety factor of eight under the maximum load. In calculating the dimensions of wire ropes they shall be assumed to be under tensile stress only.

(d) No chain or wire rope which has a knot tied in it shall be used for raising or lowering any load.

(e) Every hoisting or derricking rope or chain shall be securely fastened to the barrel of the crane, crab, or winch with which it is used.

(f) Each temporary attachment or connection of a rope, chain or other appliance used in the erection or dismantling of a crane shall be secure.

Indication of
the
maximum
safe load.

(2) Every chain, ring, hook, shackle or swivel for hoisting or lowering shall have been tested and be marked in plain figures and letters with the safe working load.

Hooks.

(3) Every hook used for hoisting or lowering shall either be provided with an efficient catch to prevent the displacement of the sling or load from the hook or shall be of such shape as to reduce as far as possible the risk of such displacement.

The parts of hooks liable to come into contact with ropes or chains during the raising or lowering of loads shall be rounded.

Slings.

(4) Where double or multiple slings are used for hoisting or lowering purposes the upper ends of the slings shall be connected by means of a shackle or ring and not be put separately into a lifting hook.

When bulky objects are being raised or lowered the maximum safe load of slings shall be determined with reference not only to their strength but also to the angle of the legs.

Sharp edges of a load shall not be in contact with slings, ropes or chains.

(5) The chains, ropes and slings of hoisting appliances shall be periodically examined by a specially competent person not in the contractor's employ.

Periodic examinations.

This person's findings shall be entered on a certificate or in a special register.

26. — *Cranes*

(1) The stage for every crane shall be built of sound material and shall be of good mechanical construction having regard to its height and position, and to the lifting and reaching capacity of the crane.

Crane stages

The platform shall be of sufficient area for the driver or operator and signalman, and, in the case of each guy derrick crane, for the operator of the slewing mechanism.

The platform shall be close-planked or plated, securely fenced according to regulation, and provided with safe means of access.

(2) Every fixed crane shall be securely anchored, or adequately weighted by suitable ballast firmly secured to ensure stability. In the latter case a diagram showing the position and size of the counterweights shall be posted up in the driver's cab.

Stability of cranes.

Every travelling crane shall be provided with a device for anchoring it to the rails of the crane track.

(3) On every stage, gantry or other place on which a crane moves, an unobstructed passageway shall be maintained at every position of the crane. This passage shall have a width of at least 60 cm. between the moving parts of the crane and the fixed parts of such stage, gantry or place.

Passage-ways.

Provided that if at any time it is impracticable to maintain such a passageway at any place or point, all reasonable steps shall be taken to prevent the access of any person to such place or point at such time.

(4) All rails on which a travelling crane moves shall:

Travelling-crane tracks.

(a) Be of adequate section and have an even running surface;

(b) Be jointed by fishplates or double chairs;

(c) Be securely fastened to sleepers.

The whole track, whether resting on the ground or raised above it, shall be properly laid and any supports shall be of sufficient strength and maintained in good condition. The ends of the track shall be provided with shoes or buffers.

Provided that requirements (b) and (c) of this regulation shall not apply to an overhead crane on bridge rails. The

track and the turntable of any such crane shall be installed with the greatest care and in conformity with sound technical principles.

Tests and
examinations
of cranes.
Certificates.

(5) No crane shall be used unless it has been tested and examined by a competent person and a certificate of such test and examination in a prescribed form specifying the safe working load, at various radii of the jib, including the maximum radius at which the jib can be worked, has been obtained from the person who made the test and examination.

The safe working load so specified at any radius shall be not more than 80 per cent. of the maximum load which the crane has stood at that radius during the application of the test.

Provided that no crane shall be used to move loads heavier than the working load indicated by the maker.

The examination, and if necessary the tests, mentioned in this regulation shall be repeated after all substantial alterations or repairs to the crane.

27. — *Derrick Cranes*

Position of
the jib.

(1) The maximum radius at which the jib may be worked shall be clearly indicated on the crane and when at this radius there shall be not less than two dead turns of rope on the derricking drum.

The jib of a Scotch derrick crane shall not be erected between the back stays of the crane.

Interlocking
of derricking
mechanism.

(2) Every crane having a derricking jib shall be provided with an effective inter-locking arrangement between the derricking clutch and the pawl sustaining the derricking drum, except where the hoisting drum and the derricking drum are independently driven or the mechanism driving the derricking drum is self-locking.

Anchorage
of derrick
cranes.
Examinations
and tests.

(3) Where the guys of a guy derrick crane cannot be fixed at approximately equal spacing, such other provisions shall be made as will ensure the safety of the crane.

The whole of the appliances for the anchorage of a crane shall be examined on each occasion before erection, and the erection shall be supervised by a competent person.

Each crane shall after each erection on a building site and before use be tested *in situ* for anchorage, by a competent person, by the imposition on each anchorage of the maximum uplift or pull exerted either by a load of 25 per cent. above the maximum load to be lifted on the site by that crane or by a less load arranged to exert an equivalent pull on the anchorage.

If the maximum load which the person making such test or examination considers may safely be lifted by that crane as anchored is less than the safe working load of the crane when properly anchored, a loading diagram appropriate to the crane anchorage shall be affixed in a position where it can readily be seen by the crane driver.

28. — *Automatic Safe Load Indicators*

No crane whether having a fixed jib or a derricking jib shall be used unless it is fitted with an automatic indicator which shall indicate clearly to the driver or person operating the crane when the load being moved approaches the safe working load of the crane at any inclination of the jib.

The indicator shall give an efficient sound signal when the load being moved is in excess of the safe working load of the crane at any inclination of the jib.

This requirement shall not apply to:

- (a) Any guy derrick crane;
- (b) Any hand crane which is being used solely for erecting or dismantling another crane;
- (c) To any crane having a maximum safe working load of 1,000 kg. or less.,

Provided that in all such cases a table showing the safe working loads at various radii of the jib shall be kept attached to the crane.

29. — *Various Rules concerning Crane Operation*

(1) A crane shall not be used otherwise than for direct lifting or lowering of a load unless its stability is not thereby endangered.

Dragging of loads by cranes prohibited.

No load which lies in the angle between the backstays of a Scotch derrick crane shall be moved by that crane.

(2) Where more than one crane or winch is required to lift or lower one load, the machinery, plant and appliances used shall be so arranged and fixed that no such crane or winch shall at any time be loaded beyond its safe working load or rendered unstable in the hoisting or lowering of the load. Further, a person shall be specially appointed to co-ordinate the operation of the appliances working together.

Use of more than one appliance to move one load.

(3) When a load is thought to approach the maximum safe working load a trial shall be made by raising the load a short distance to ensure that the hoisting appliance can carry it safely.

Preliminary trial in certain cases.

30. — *Hoists*

Hoists used for raising and lowering materials shall satisfy the following requirements:

Protective walls.

(1) Hoist shafts shall be provided with solid walls on all sides at the ground level, and on the side towards the platform on scaffold platforms. Except as regards approaches the walls shall extend at least 2 m. above the floor or platform.

Gates.

(2) Approaches to hoists shall be provided with solid gates at least 1 m. high that close automatically when the hoist platform leaves the landing.

Lighting.

(3) Approaches to hoists shall be adequately lighted.

Platform guides.

(4) The guides of hoist platforms shall offer sufficient resistance to bending and in the case of jamming by a safety catch shall offer sufficient resistance to buckling.

Construction of the platform.

(5) The platform shall be so constructed that safe transport is ensured.

Transport of trucks.

(6) On platforms for truck transport the trucks shall be efficiently blocked in the middle of the platform.

Safety catches.

(7) The platform shall be provided with a safety catch that prevents it from falling if the rope or a part of the suspension gear breaks.

Counterweights and guides.

(8) (a) Counterweights consisting of an assemblage of several parts shall be made of specially constructed parts rigidly connected together.

(b) The counterweight shall run in guides.

Load and suspension ropes.

(9) (a) If two or more wire ropes are used the load shall be equally distributed between them.

(b) Each suspension rope shall be in one piece.

Fastening of ropes.

(10) (a) The rope ends shall be fastened to the platform attachment by splicing and tight binding with steel wire, by sealing or by clamping with the aid of rope clamps; wherever possible, thimbles shall be used.

(b) Ropes shall be attached to the drum by being passed through the drum and fastened inside or by some equivalent method.

Dimensions of ropes, pulleys and drums.

(11) (a) The length and diameter of ropes shall be in conformity with the provisions of Section 25 (1) (a) and (c) respectively.

(b) The dimensions and construction of pulleys and drums shall be in conformity with the provisions of section 24 (2).

- (12) (a) It shall only be possible to start the winding engine for raising or lowering from its position of rest. It shall not be possible to start the engine from the platform. Installation of the winding engine.
- (b) Pawls and ratchet wheels with which the pawl must be disengaged before the platform is lowered shall not be employed.
- (c) Hoists that can be controlled from the winding engine shall be so installed that the engine attendant can always see the position of the platform from his stand.
- (13) When the platform is at rest the brake shall be applied automatically. In addition, during loading and unloading the platform shall be blocked by catches or other similar devices. Blocking of platform during loading and unloading.
- (14) Hoists shall be provided with devices that stop the winding engine as soon as the platform reaches its highest stopping-place. Stopping devices.
- (15) The following notices shall be posted up conspicuously and in very legible characters: Notices.
- (a) *On the platform*: the carrying capacity in kilograms;
 - (b) *On the winding engine*: the lifting capacity in kilograms;
 - (c) *On every approach to the hoist*: Goods Hoist! Use by persons prohibited.

31. — *Miscellaneous Rules*

- (1) Precautions shall be taken to safeguard the workmen examining or lubricating a crane or hoist. Precautions during examination and lubrication.
- (2) No person shall be lifted or carried by a crane except on the driver's platform, or ride in a barrow hoist, or in a hod hoist, or in a lift, provided that a person may ride in a lift if the lift complies with the regulations applying to factory lifts carrying passengers. Conveyance of persons prohibited.
- (3) No article or material shall be lifted or lowered in such a way that it may be caused to fall by a sudden shock; in particular the lifting or lowering of loose material and of loaded wheelbarrows on a platform not closed in shall be prohibited. Precautions during raising or lowering of materials.
- Provided that this regulation shall not apply if adequate precautions are taken to prevent persons from being injured by falling materials or articles.
- (4) In hoisting a barrow, the wheel shall not be used as a means of support unless efficient steps are taken to prevent the axle from slipping through the bearing. Hoisting of barrows.
- (5) When a special ginpole is used, it shall be secured by ropes in such a way that it cannot knock against the scaffolding. Ginpoles.

Fixing of jibs
on scaffolds
prohibited.

(6) Jibs for hoisting materials shall not be attached to standards or extension poles.

When no jib, but only a rope pulley is used, the latter may be attached to a cross beam fixed to at least two standards or extensions in the way prescribed for ledgers; these cross beams shall not at the same time serve as ledgers for the scaffold.

Precautions
when hoisting
appliances
move along
scaffolds.

(7) If a hoisting appliance or any part thereof moves along a scaffold, adequate measures shall be taken to prevent persons on the scaffold from being struck by the appliance or any part of it.

Hoisting
of loads
at traffic
carrying
places.

(8) The hoisting of loads at points where there is a regular flow of traffic shall be carried out in an enclosed space. If this should be impossible, e.g. in the case of bulky objects, measures shall be taken to hold up or divert the traffic for the time being.

Baskets.

(9) No basket depending entirely for support on its handles shall be used for hoisting or lowering materials.

PART III

SAFETY EQUIPMENT AND FIRST AID

32. — *Safety Equipment*

Where necessary the employer shall provide the workmen with a sufficient number of goggles and safety belts, the latter to have life lines of sufficient length and strength.

33. — *Rescue Equipment*

When work is carried on above rivers, ponds, or canals the employer shall take all the necessary measures and furnish all the necessary means for the prompt rescue of any worker who may fall into the water.

34. — *First-Aid Equipment*

On every building under construction the employer shall provide in a readily accessible place, or places, a sufficient number of first-aid boxes or cupboards. Each such box or cupboard shall contain suitable first-aid materials and shall be plainly marked.

APPENDIX

LIST OF LAWS AND REGULATIONS

GERMANY

German Lift Regulations. Technical Principles for the Construction of Lifts. Part E: Power-driven Building Hoists. 8 June 1929.
(*Reichsarbeitsblatt*, No. 17, 15 June 1929, p. I. 121.)

Standard Accident Prevention Regulations of the Federation of Mutual Accident Insurance Associations. 1 January 1930.

Accident Prevention Regulations for the erection of steel structures. 1 April 1934.

ARGENTINA

Act of 29 September 1915 respecting industrial accidents. (No. 9688.)
(L.A.,¹ Tomo XIX, p. 204.)

Act of 30 September 1912 respecting the organisation of the National Labour Department.

(L.A., Tomo XVIII, p. 118.)

Decree issuing regulations under the Act of 29 September 1915. 14 January 1916.

(C.M.,² No. 149/150, July-August 1930.)

Act No. 11570 of 25 September 1929 respecting the control and enforcement of the Labour Acts.

(C.M., 1929, p. 2919.)

AUSTRALIA

New South Wales

Act to consolidate the Acts controlling scaffolding and lifts. (Scaffolding and Lifts Act), 26 November 1912.

(S.N.,³ 1912, p. 346.)

Proclamation of 14 June 1927 amending the regulations under the Scaffolding and Lifts Act 1912.

(N.G.G.,⁴ No. 87, p. 3421.)

Proclamation of 26 February 1929 to issue new regulations 3A under the Scaffolding and Lifts Act 1912.

(N.G.G., No. 29, p. 1056.)

Proclamation of 17 September 1929 to make regulations under the Scaffolding and Lifts Act 1912.

(N.G.G., No. 127, p. 3886.)

¹ L.A. = *Legislación Argentina: Colección completa de las Leyes Nacionales.*

² C.M. = *Cronaca Mensual del Departamento Nacional del Trabajo.*

³ S.N. = *Statutes of New South Wales.*

⁴ N.G.G. = *New South Wales Government Gazette.*

Northern Territory

Ordinance relating to the inspection of scaffolding and for other purposes. No. 8 of 17 February 1932.

(*Commonwealth of Australia Gazette*,
11 February 1932, No. 14, p. 228.)

Queensland

Act to make better provision for the inspection of scaffolding. (Inspection of Scaffolding Act), 22 December 1915.

(*The Queensland Statutes*, Vol. VIII, p. 6888.)

Regulations under the Inspection of Scaffolding Act 1915. 25 February 1916.
(L.Q.,¹ p. 333.)

Amended Regulations under the Inspection of Scaffolding Act 1915. 3 October 1929.

(Q.G.G.,² Vol. CXXXIII, p. 979.)

Regulations under the Inspection of Scaffolding Act 1915. 24 December 1930.
(Q.G.G., Vol. CXXXV, p. 3111.)

Inspection of Machinery Act. 22 December 1915.

(L.Q., p. 259.)

Regulations under the Inspection of Machinery Act. 13 April 1916.

(L.Q., p. 288.)

Amending Regulations under the Inspection of Machinery Act. 24 December 1930.

(Q.G.G., Vol. CXXXV, p. 3127.)

Act No. 6 of 25 September 1930 to amend the Inspection of Machinery Acts 1915-1925 and other Acts in certain particulars.

(*Acts of the Parliament of Queensland: Session of 1930*, Vol. XV, part 2, p. 12977.)

South Australia

Act to consolidate certain Acts providing for the inspection of scaffolding and for other purposes. (Scaffolding Inspection Act 1934), 8 November 1934.

Tasmania

Act to consolidate and amend the law relating to the inspection and regulation of machinery. (Inspection of Machinery Act.) 1 November 1902.

Act to amend the Inspection of Machinery Act 1902. 30 December 1909.

Victoria

Act to provide for the inspection of scaffolding and for other purposes. (Scaffolding Inspection Act), 21 December 1922.

Additional regulations under the Scaffolding Inspection Act of 1922. 31 March 1927.

(V.G.G.,³ 1927, p. 1476.)

Additional regulations under the Scaffolding Inspection Act of 1922. 28 April 1927.

(V.G.G., 1927, p. 1629.)

Western Australia

Act to make provision for the inspection of scaffolding. (Inspection of Scaffolding Act), 16 January 1925.

Act to amend the Inspection of Scaffolding Act. 6 November 1926.

Order in Council of 9 February 1927 making regulations under the provisions of the Inspection of Scaffolding Act, as amended.

(W.A.G.,⁴ 1927, p. 359.)

¹ L.Q. = *The Labour Laws of Queensland*.

² Q.G.G. = *Queensland Government Gazette*.

³ V.G.G. = *Victoria Government Gazette*.

⁴ W.A.G. = *Western Australia Government Gazette*.

Order in Council 24 April 1928 making regulations under the provisions of the Inspection of Scaffolding Act as amended.

Inspection of Machinery Act. 10 February 1922. (W.A.G. 1928, p. 1025.)

Amended Regulations under the Inspection of Machinery Act, 29 July 1925. (W.A.G., 1925, p. 1355.)

AUSTRIA

Order issued by the Minister of Commerce in agreement with the Minister of the Interior concerning the safety and health of workers employed in the building industry. 7 February 1907.

(R.G.B.,¹ No. 24.)

Order of the Ministry of Commerce in agreement with the Minister of the Interior concerning the establishment of a special building inspectorate for Vienna. 7 May 1911.

(R.G.B. 1911, p. 401.)

Order concerning the extension of the competence of the Vienna industrial inspectorate for building operations. 28 May 1923.

(*Amtliche Nachrichten*, 1923, p. 268; B.G.B.,² No. 312.)

Act relating to industrial inspection. 14 July 1921.

(L.S.³ 1921, Aus. 4-5.)

Act concerning the establishment of works communities. 12 July 1934.

(L.S. 1934, Aus. 7.)

BELGIUM

Royal Order prescribing special measures to be taken in the building industry and constructional and excavating work in general. 31 March 1905.

(B.B.,⁴ Tome IV, 1905.)

Royal Order to issue regulations respecting hoisting appliances and overhead railways in use in industrial and commercial undertakings other than those for underground work in mines, open workings and quarries. 20 February 1933. Amended by Royal Order of 11 September 1933.

(L.S. 1933, Belg. 7.)

BULGARIA

Order concerning the safety of building workers. 4 May 1935.

(*Driaven Vestnik*, No. 99, 4 May 1935; L.S. 1935, Bulg. 6.)

CANADA

Alberta

Act for the protection of persons employed in the construction of buildings and excavations. 1922. (Building Trades Protection Act.)

(R.S.,⁵ 1922, Vol. III, Ch. 193.)

Act amending the Building Trades Protection Act. 21 March 1928.

(S.A.,⁶ 1928, Ch. 41.)

Regulations issued by the Workmen's Compensation Board, in accordance with the provisions of the Workmen's Compensation Act (Accident Fund) 15 May 1925.

(A.G.,⁷ 1925, Vol. XXI, No. 9, p. 221.)

Regulations revised 14 July 1928 and 31 August 1928.

(A.G. 1928, Vol. XXIV, No. 14, p. 436, and No. 16, p. 512.)

¹ R.G.B. = *Reichsgesetzblatt*.

² B.G.B. = *Bundesgesetzblatt*.

³ L.S. = *Legislative Series*; International Labour Office, Geneva.

⁴ B.B. = *Bulletin de l'Office international du Travail*, Basle.

⁵ R.S. = *Revised Statutes of Alberta*.

⁶ S.A. = *Statutes of Alberta*.

⁷ A.G. = *Alberta Gazette*.

Manitoba

Act for the protection of persons employed in the construction of buildings and excavations. 26 March 1912. (Building Trades Protection Act.)
(S.M.¹ 1912, Ch. 8, p. 20.)

Act to amend the Building Trades Protection Act. 15 February 1913.
(S.M. 1913, Ch. 4, p. 14.)

Ontario

Act for the protection of persons employed in the construction of buildings. 24 March 1911. (Building Trades Protection Act.)
(S.O.² 1911, Ch. 71, p. 505.)

Quebec

Act respecting the inspection of scaffolding. 25 April 1908.
(S.Q.³ 1908, Ch. 53, p. 107, amended 1930., (Ch. 77.)

Standard Scaffoldings approved by the Lieutenant-Governor in Council.
(Code of Labor and Industrial Laws of the Province of Quebec. Compiled and edited by Gus. Francq, Montreal, 1933.)

Saskatchewan

Act for the protection of persons employed in the construction of buildings. 15 March 1912. (The Building Trades Protection Act.)
(S.S.⁴ 1912, Ch. 18, p. 78.)

CHILE

Act No. 4054 to provide for compulsory insurance against sickness, invalidity and industrial accidents. 8 September 1924.
(L.S. 1924, Chile 1.)

Decree No. 217 to approve the appended regulations concerning industrial safety and hygiene. 30 April 1926.
(Boletino de las Leyes i Decretos, Vol. XCV, No. 10226, Jan.-June 1926, p. 935.)

Decree No. 304 to approve the building and town-planning regulations. 14 January 1930.
(D.O.⁵ February 1930, p. 929.)

Decree of 15 November 1933 respecting the labour inspectorate.
(D.O., December 1933, p. 3767; extracts in L.S. 1933, Chil. 1.)

COSTA RICA

Act respecting Compensation for Industrial Accidents. 31 January 1925.
(L.S. 1925, C.R. 1.)

CUBA

Decree No. 596 to issue regulations under the Act of 12 June 1916 respecting compensation for industrial accidents. 29 April 1928.
(G.O.⁶ 1928, p. 8809.)

Legislative Decree No. 418 fixing the organisation of the Secretariat of Labour. 15 August 1934.
(G.O. 20 August 1934, No. 43, p. 3,089.)

Act No. 91 concerning the Secretariat of Labour. 12 April 1935.
(G.O. [Extraordinary] No. 22, 16 April 1935, p. 1.)

¹ S.M. = Statutes of Manitoba.

² S.O. = Statutes of Ontario.

³ S.Q. = Statutes of Quebec.

⁴ S.S. = Statutes of Saskatchewan.

⁵ D.O. = Diario Oficial.

⁶ G.O. = Gaceta Oficial.

DENMARK

Building Act of 12 April 1889, amended by Act No. 153 of 8 June 1912. (Applies to Copenhagen and suburbs.)

Building Act of 30 December 1858 amended by Act No. 7 of 3 January 1890. (Applies to rest of the country.)

Regulations concerning the construction and use of lifts and hoists worked by mechanical power, issued by the Directorate of Factory Inspection 22 August 1922, amended 1 January 1928.

(Guide for factory inspectors and inspection assistants
(*Vejledning for Fabriksinspektorer og Tilsynsassistenten*). With supplements dated 1 January 1928.)

Notification No. 207, respecting, the installation and use of machine driven cranes. 14 July 1928. (L¹ 1928, p. 1170). Amended by notification No. 220 of 25 August 1932.

(L. 1932, p. 1295.)

Notification, No. 309, respecting the installation and use of power-driven lifts and hoists. 16 November 1935.

(L. 1935, p. 1188.)

DOMINICAN REPUBLIC

Departmental Order No. 3 issued under Act No. 385 of 11 November 1932 concerning industrial accidents. 20 November 1932.

(Gaceta Oficial. No. 4534, 28 December 1932, p. 3.)

ECUADOR

Decree No. 24: Act respecting the prevention of industrial accidents. 4 March 1927.

(L.S. 1927, Ec. 1.)

Decree of 13 July 1926 to set up a General Labour Inspectorate.

(R.O.² 1926, No. 83, p. 759.) (L.S. 1926, Ec. 1.)

Regulations of 29 July 1926 concerning the General Labour Inspectorate.

(R.O. No. 99, p. 897.) (L.S. 1926, Ec. 1.)

SPAIN

Royal Decree laying down the requirements to be satisfied by partially or completely suspended scaffolds used for the plastering or repair of frontages, 23 January 1916.

(L.T.³ 1916, p. 247.)

Royal Order laying down regulations for the enforcement of the Royal Decree of 23 January 1916. 29 April 1916.

(L.T. 1916, p. 250.)

Act relating to industrial accidents, as amended, 10 January 1922.

(L.S. 1922, Sp. 1.)

Royal Decree to approve the Labour Code, 23 August 1926.

(L.S. 1926, Sp. 5.)

Regulations for the enforcement of the Act of 13 May 1932 concerning provincial labour delegations. 23 June 1932.

(*Anuario español de Política Social*, 1934-1935, p. 137.)

ESTONIA

Regulations concerning accident prevention in the building industry.

(*Eesti Töölise Kinnitushisus. Määrused onneluste arahoid miseks ehitusöödel* 1925 a. trukk.)

¹ L. = *Lovtidenden, Afdeling A.*

² R.O. = *Registro Oficial.*

³ L.T. = *Legislación del Trabajo, Apéndice Duodécimo*, 1916.

UNITED STATES

Arizona

A Safety Code for Workers in the Construction Industry. Adopted by the Industrial Commission of Arizona. Amended 15 March 1935.

California

Section 402 c (as amended 1921) of the Penal Code of 1906.

(B. 370¹.)

Bureau of Labor Statistics Act (No. 1828) of 1906.

(B. 370.)

Chapter 590 of the Acts of 1911 (amended 1921, Ch. 334).

(B. 370.)

Chapters 148 and 275 of the Acts of 1913.

(B. 370.)

General Construction Safety Orders: Department of Industrial Relations
1 July 1926.

Colorado

Compiled laws of 1921 (sections 4186-4188).

(B. 370.)

Connecticut

General Statutes of Connecticut, 1918, section 5311 (amended 1919, Ch. 93).

(B. 370.)

Delaware

Chapter 234 of the Acts of 1921.

(B. 370.)

Illinois

Chapter 48 of the revised Statutes of 1917.

(B. 370.)

Indiana

Section 3862 of the Statutes of 1914.

(B. 370.)

Building rules and regulations: Administrative Building Council of Indiana
15 October 1928.

Kansas

Section 5894 of the General Statutes of 1915.

(B. 370.)

Kentucky

Chapter 124 of the Acts of 1926.

(B. 434.²)

Louisiana

Act No. 264 of 1908.

(B. 370.)

Maryland

Article 48 of the Public General Laws (Code of 1911, 1914).

(B. 370.)

¹ U.S. DEPARTMENT OF LABOR, BUREAU OF LABOR STATISTICS: *Bulletin* No. 370, "Labor Laws of the United States with Decisions of Courts relating thereto", 1925.

² U.S. DEPARTMENT OF LABOR, BUREAU OF LABOR STATISTICS: *Bulletin* No. 434, "Labor Legislation of 1926", Washington, 1927.

Massachusetts

Chapter 143 of the General Laws of 1921.

(B. 370.)

Rules and regulations for the prevention of accidents in building operations.
(Department of Labor and Industries, Industrial Bulletin 12.)

Revised rules and regulations pertaining to the painting business, 1925.
(Department of Labor and Industries, Industrial Bulletin 13.)

Minnesota

Section 3873-3876 of the General Statutes of 1913.

(B. 370.)

Missouri

Section 6802 of the revised Statutes of 1919.

Act of 1927 for the protection of employees on buildings.

(B. 370.)

(B. 470.1)

Montana

Sections 2672-2676 of the Revised Codes of 1921.

(B. 370.)

Nebraska

Sections 7702-7712 of the compiled Statutes of 1922.

(B. 370.)

Nevada

Chapter 225 of the Acts of 1919.

(B. 370.)

New Jersey

Chapter 168 of the Acts of 1917.

(B. 370.)

Chapter 185 of the Acts of 1930.

(B. 552.²)

New York

Article X of the Consolidated Laws of 1907 (amended 1932, Ch. 470).

(B. 370 and B. 590.³)

Chapter 603 of the Acts of 1930.

(B. 552.)

Rules relating to the erection, repair or demolition of buildings. 15 April 1920.
(Department of Labor, *Industrial Code Bulletin* No. 23.)

North Dakota

Chapter 42 of the Acts of 1921.

(B. 370.)

Ohio

Sections 12576, 12577, 12593 and 12594 of the General Code of 1910.

(B. 370.)

Specific safety requirements relating to building and construction work
(Revised, March 1931).

(Bulletin No. 202 of the Department of Industrial
Relations and the Industrial Commission of Ohio.)

¹ U.S. DEPARTMENT OF LABOR, BUREAU OF LABOR STATISTICS : *Bulletin* No. 470,
"Labor Legislation of 1927", Washington, 1928.

² U.S. DEPARTMENT OF LABOR, BUREAU OF LABOR STATISTICS : *Bulletin* No. 552,
"Labor Legislation 1930", Washington, 1931.

³ U.S. DEPARTMENT OF LABOR, BUREAU OF LABOR STATISTICS : *Bulletin* No. 590,
"Labor Legislation 1931 and 1932", Washington, 1933.

Oklahoma

Sections 3772-3775 of the revised laws of 1910.

(B. 370.)

Oregon

Sections 6785-6790 of the laws of 1920.

(B. 370.)

Pennsylvania

Sections 2941-2943 of the Statutes of 1920.

(B. 370.)

Regulations for construction and repairs, 1933, Department of Labor and Industry.

Safety standards for cranes and hoists, 1924, Department of Labor and Industry.

Safety standards of the Industrial Board: Ladders, 1916, Department of Labor and Industry.

Rhode Island

Chapter 93 of the General Laws of 1923.

(B. 370.)

Chapter 591 of the Acts of 1925.

(B. 403.1)

Texas

Chapter 152 of the Acts of 1919.

(B. 370.)

Washington

Chapter 130 of the Acts of 1919.

(B. 370.)

West Virginia

Chapter 83 of the Laws of 1929.

(*American Labor Legislation Review*, Vol. XIX, 1929, p. 435.)

Wisconsin

General Orders on Safety in Construction. Effective 15 July 1933. Industrial Commission of Wisconsin.

Building Code. Revised 1921. Industrial Commission of Wisconsin.

Porto Rico

Act No. 30 of 1913 as amended 1923, No. 25.

(B. 370.)

FINLAND

Resolution of the Council of State issuing regulations for house-building, 15 November 1927.

(L.S. 1927, Fin. 2 E.)

Decree of the Ministry of Commerce and Industry to issue regulations for the manufacture, installation operation, minding and inspection of lifts and hoists. 17 August 1933.

(F.F.² 1933, No. 235, p. 607.)

Resolution of the Council of State to issue regulations for the construction, installation, operation, minding and inspection of lifts and hoists, 15 February 1934.

(F.F. 1934, No. 80, p. 217.)

¹ U.S. DEPARTMENT OF LABOR, BUREAU OF LABOR STATISTICS: *Bulletin No. 403*, "Labor Legislation of 1925", Washington, 1926.

² F.F. = *Finlands Författningssamling*.

Decree of the Ministry of Commerce and Industry amending the regulations of 17 August 1933. 8 October 1934.

(F.F. 1934, No. 364, p. 746.)

Labour Inspection Act, 4 March 1927.

(F.F. 1927, No. 72.)

FRANCE

Decree of 10 July 1913, issuing public administrative regulations to give effect to the provisions of Book II of the Code of Labour and Social Welfare as regards general measures of protection and hygiene applicable to all the establishments covered.

(R.T. ¹ 623.)

Act to amend section 68 of the Second Book of the Labour Code. 9 March 1931.

(L.S. 1931, Fr. 3 (B); R.T., p. 81.)

Decree issuing public administrative regulations to give effect to the provisions of Book II of the Labour Code as regards special measures of protection and hygiene applicable to buildings and public works under construction. 9 August 1925.

(R.T., p. 672; L.S. 1925, Fr. 10.)

Amended 26 November 1934.

(J.O.², 9 Dec. 1934, No. 289, p. 12066; L.S., 1934, Fr. 9.)

GREAT BRITAIN

The Factory and Workshop Act. 17 August 1901.

(Public General Acts 1901.)

Regulations for the generation, transformation, distribution and use of electrical energy in premises under the Factory and Workshop Acts, 1901 and 1907. 23 December 1908.

The Building Regulations 1926, dated 21 June 1926, made by the Secretary of State under section 79 of the Factory and Workshop Act 1901, in respect of certain building operations.

(L.S. 1926, G.B. 4.)

The Building (Amendment) Regulations 1931, dated 30 September 1931 made by the Secretary of State under section 79 of the Factory and Workshop Act 1901 in respect of cranes and other hoisting and lifting appliances used in certain building operations.

(L.S. 1931, G.B. 10.)

GREECE

Act No. 3934 concerning the protection of workers, 19 November/2 December 1911.

Decree respecting the installation and operation of electrically driven hoisting apparatus in Greece. 17 November 1931.

(E.K.,³ p. 3319.)

Decree to amend certain provisions of the Decree of 17 November 1931, 27 December 1933.

Decree respecting safety measures for wage-earning and salaried employees working on portable ladders. 22 December 1933.

(L.S. 1933, Gr. 1.)

Decree codifying the statutory provisions concerning the labour inspectorate. 1934.

(L.S. 1934, Gr. 2.)

¹ R. T. = *Lois, décrets, arrêtés concernant la Réglementation du Travail* (Documents réunis par le Ministère du Travail). Librairie Berger-Levrault, Paris, 1934.

² J. O. = *Journal Officiel*.

³ E. K. = *Empheris tes Kuberneseos*.

GUATEMALA

Labour Protection Act (Decree 669). 21 November 1906.

(Edición oficial, 1906.)

HUNGARY

Act No. XXVIII of 1893 concerning factory inspectors and the protection of industrial and factory workers against accidents.

(U.R.S.¹ 1893, p. 656.)

Order of 1898 extending the scope of inspectors' activities to cover building operations.

IRISH FREE STATE

The Building Regulations 1930, dated 5 March 1930, made by the Minister for Industry and Commerce under section 79 of the Factory and Workshop Act 1901 in respect of certain building operations.

ITALY

General Regulations for the prevention of industrial accidents in undertakings and industries covered by the Act of 17 March 1898 (No. 80): Royal Decree No. 230, 26 June 1899.

(C.L.², p. 118.)

Regulations for the prevention of accidents in building work covered by the Act of 17 March 1898 (No. 80): Royal Decree No. 205 of 27 May 1900.

(C.L., p. 143.)

Ministerial Circular No. 10048 issuing instructions concerning the enforcement of the General Regulations (R.D. 18 June 1899, No. 230) concerning the prevention of industrial accidents. 9 September 1925.

Act No. 886 concerning the establishment of the Corporative Factory Inspectorate. 16 June 1932.

(Gazzetta Ufficiale, 5 August 1932, No. 180, p. 3626; L.S. 1932, It. 5.)

JAPAN

Act No. 54 concerning the relief of workers in case of accident 1 April 1931.

(L.S. 1931, Jap. 1.)

LATVIA

Act concerning the insurance of paid employees against accidents and occupational diseases. 1 June 1927.

(L.S. 1927, Lat. 1.)

LUXEMBURG

Act respecting the health and safety of persons employed in workshops, in industrial and commercial undertakings or in work in construction, adaptation, repairs or excavations. 28 August 1924.

(L.S. 1924, Lux. 2.)

Grand Ducal Order respecting the health and safety of persons employed in work in construction, adaptation, repairs or excavation. 28 August 1924.

(L.S. 1924, Lux. 2.)

¹ U.R.S. = *Ungarische Reichsgesetzsammlung*.

² C.L. = *Codice del Lavoro*, 1925.

Grand Ducal Order relating to the institution of workers' committees in industrial establishments. 8 May 1925.

(L.S. 1925, Lux. 1.)

Act concerning the labour inspectorate. 22 May 1902.

(A.L.T.¹ 1902, Vol. 6, p. 388.)

MEXICO

Federal Labour Act. 18 August 1931.

(L.S. 1931, Mex. 1.)

Regulations concerning the prevention of industrial accidents. 28 November 1934.

(D.O.² 29 November 1934; *Revista Mexicana del Trabajo*, Dec. 1934 and Jan.-Feb. 1935.)

Regulations of 23 October 1934 on the Federal Labour Inspectorate.

(D.O. 3 November 1934, No. 3, p. 50.)

NICARAGUA

Act respecting industrial accidents. 13 May 1930.

(L.S. 1930, Nic. 1.)

NORWAY

The Building Act of 22 February 1924.

(N.T.³ No. 8, 27 February 1924, p. 116.)

The Building regulations of 6 October 1928.

(N.T. No. 39, 13 October 1928, p. 586.)

NEW ZEALAND

The Scaffolding and Excavation Act (No. 49), 31 October 1922.

(S.N.Z.⁴ 1922, p. 250.)

Act to amend the Scaffolding and Excavation Act 1922 (No. 35), 29 October 1924.

(S.N.Z. 1924, p. 268.)

Regulations under the Scaffolding and Excavation Act 1922. 11 November 1935.

(*The New Zealand Gazette*, 21 November 1935.)

Inspection of Machinery Act (No. 17), 2 October 1928.

(S.N.Z. 1928, p. 217.)

Act No. 48 of 11 November 1931, to amend the Inspection of Machinery Act 1928.

(*The Public Acts of New Zealand 1908-1931*, Vol. V, p. 552.)

PARAGUAY

Act No. 926 respecting industrial accidents. 7 September 1927.

(L.S. 1927, Para. 1.)

NETHERLANDS

The Safety Act 1895, as amended 2 July 1915.

(B.B.⁵ 1916, p. 18.)

¹ A.L.T. = *Annuaire de la Législation du Travail*.

² D.O. = *Diario oficial*.

³ N.T. = *Norsk Lovtidende*.

⁴ S.N.Z. = *New Zealand Statutes*.

⁵ B.B. = *Bulletin of the International Labour Office*, Basle.

The Labour Act, 1919, as amended 21 July 1922.

(L.S. 1922, Neth. 1.)

Decree to issue general administrative regulations under sections 6 and 7 of the Safety Act. 21 August 1916.

Decree to issue public administrative regulations under section 10 (1) of the Labour Act. 10 August 1920.

(L.S. 1920, Neth. 8.)

Act to issue regulations respecting safety in the performance of work in general and safety in factories and workplaces in particular. 2 July 1934.

(S.B.¹ 1934, No. 352; L.S. 1934, Neth. 2.)

Circular of the Factory Inspectorate concerning round-timber mason's scaffolding and fittings, 1934.

PERU

Decree regulating protective measures in industrial establishments. 4 July 1913.

(*Legislación del Trabajo y Previsión Social*,
Lima, 1913 p. 121.)

POLAND

Decree of the Ministers of the Interior and Social Assistance concerning measures of safety and hygiene in building operations. 23 May 1935.

(D.U.,² No. 50, 17 July 1935, p. 839; L.S. 1935, Pol. 3.)

Decree of the President of the Republic concerning labour inspection. 14 July 1927.

(L.S. 1927, Pol. 8.)

Order respecting the inspection of building operations. 14 September 1935.

(D.U., No. 70, 25 September 1935, p. 1217.)

RUMANIA

Accident prevention regulations issued by the Central Social Insurance Institute. June 1934.

(*Monitorul Oficial*, No. 133, 13 June 1934.)

SWEDEN

Act of 29 June 1912 respecting the protection of workers, with the amendments made by the Act of 12 June 1931.

(L.S. 1931, Swe. 5 a and b.)

SWITZERLAND

Confederation

Sickness and Accident Insurance Act, 13 June 1911.

(V.A.S.,³ Vol. II, p. 759.)

Basle Town

Building Act of 10 October 1918.

(V.A.S., p. 437.)

Berne

Act of 4 November 1900 amending the Act of 15 July 1894 concerning the drawing up of alignment plans and building regulations by the communes.

(V.A.S., p. 180.)

Geneva

Order respecting the safety of workers employed in the repair or construction of buildings. 17 February 1928.

(L.S. 1928, Switz. 3.)

¹ S.B. = *Staatsblad*.

² D.U. = *Dziennik Ustaw*.

³ V.A.S. = *Volkswirtschaft, Arbeitsrecht und Sozialversicherung der Schweiz*, 1925. Herausgegeben vom Eidgenössischen Volkswirtschaftsdepartement.

Order amending the Order of 17 February 1928, 6 July 1928.

(L.S. 1928, Switz. 3.)

Regulations concerning the precautions to be taken for the prevention of accidents in building and on public works, 25 March 1930.

(Extracts in L.S. 1930, Switz. 2.)

Order of 14 August 1931 respecting lifts and hoists.

(F.A.,¹ No. 195, p. 1731.)

Glarus

The Workers' Protection Act, 6 May 1923.

(L.S. 1923, Switz. 4.)

Administrative Order under the Workers' Protection Act issued by the State Council, 8 January 1924.

(L.S. 1924, Switz. 4.)

Lucerne

Building Act of 26 November 1913 for the Town of Lucerne.

(V.A.S., p. 243.)

Neuchâtel

Building Act of 26 March 1912.

(V.A.S., p. 718.)

Regulation concerning safety measures for workmen occupied in the building industry, 17 September 1912.

(V.A.S., p. 718.)

Schaffhouse

Ordinance concerning accident prevention in the building industry, 19 February 1913.

(V.A.S., p. 463.)

Schwyz

Building Regulations of 5 November 1905.

(V.A.S., p. 260.)

Solothurn

Act concerning the building industry, 10 June 1906.

(V.A.S., p. 346.)

Zürich

Order concerning the protection of the life and health of persons employed in the building industry, and the duties of the scaffolding inspectorate. Building Supervision Order of the City of Zurich. 31 January 1931.

CZECHOSLOVAKIA

Order respecting the safeguarding of health and the prevention of accidents for persons employed in the constructional industry, 26 March 1931.

(L.S. 1931, Cz. 1.)

Act concerning factory inspectors, 17 June 1883.

Order concerning the establishment of special inspectorates for the building industry at Prague and Brno, 23 March 1920.

(S.G.V.² 1920, p. 455.)

Act respecting Works Councils. 12 August 1921.

(L.S. 1921, Cz. 4.)

TURKEY

Act of 3 April 1920 (No. 1580) concerning municipalities.

Act of 29 November 1913 concerning power plant.

¹ F.A. = *Feuille d'Avis officielle de la République et Canton de Genève.*

² S.G.V. = *Sammlung der Gesetze und Verordnungen.*

UNION OF SOVIET SOCIALIST REPUBLICS

Binding Order No. 173 of the People's Labour Commissariat of the U.S.S.R. concerning constructional work, 5 May 1930.

(I.N.K.T.¹ 1930, No. 14-15, p. 335; No. 15, p. 364.)

Order No. 8 of the People's Labour Commissariat of the U.S.S.R. concerning working clothes, and protective equipment. 23 January 1933.

(I.N.K.T. 1933, No. 11, p. 99.)

Binding Order No. 75 of the People's Labour Commissariat issuing regulations concerning the construction, installation, examination, supervision and use of elevators, passenger lifts and goods lifts. 27 March 1931.

(I.N.K.T. 1931, No. 10.)

Instructions for the Labour Inspectorate, approved under Order No. 322/415 of the People's Labour Commissariat of the U.S.S.R., 24 December 1925.

(L.S. 1925, Russ. 12.)

Order of the Council of People's Commissaries of the U.S.S.R. respecting public labour protection inspectors, 30 June 1931.

(L.S. 1931, Russ. 8 B.)

UNION OF SOUTH AFRICA

Act to amend the Factories Act 1918, and to provide for the supervision and control of certain machinery. No. 26 of 1931.

(U.G.G.² (Extraordinary), 5 June 1931, No. 1956, p. xii.)

Government Notice No. 1247 under section 12 of the Factories (Amendment) Act 1931, No. 26, to make regulations dealing with the supervision and control of certain machinery. 31 July 1931.

(U.G.G., 31 July 1931, No. 1968, p. 234.)

Capetown: Amended Regulation relating to needle scaffolds, 7 February 1924.

Johannesburg: General Rules—Scaffolding.

URUGUAY

Act for the prevention of industrial accidents, 21 July 1914.

Decree issuing regulations under the Act of 21 July 1914, 14 April 1915.

Decree No. 1272/927 to supplement the regulations under the Act respecting the prevention of industrial accidents. 4 January 1928.

(L.S. 1928, Ur. 1.)

Decree to amend section 1 of the Decree of 14 April 1915 with respect to industrial accidents in demolition operations. 27 September 1929.

(D.O.³ 6976, p. 39 — A.)

Decree to add sections to the Decree of 4 January 1928 respecting safety measures in the erection of reinforced concrete buildings. 18 October 1929.

(D.O. 6993, p. 238 — A.)

Decree to amend a provision of the Decree of 14 April 1915 respecting the prevention of industrial accidents. 13 June 1930.

(D.O. 7188, p. 667 — A.)

² I.N.K.T. = *Izvestia Narodnovo Komisariata Truda.*

³ U.G.G. = *Union of South Africa Government Gazette.*

¹ D.O. = *Diario Oficial.*

Decree to substitute a new clause for one of the provisions concerning demolition operations in the Decree of 27 September 1929. 21 August 1931.
(D.O. No. 7523, p. 487 — A.)

Act amending section 7 of the Act of 21 July 1914. 21 August 1935.
(D.O. No. 8704, p. 306 — A; L.S. 1935, Ur. 3.)

YUGOSLAVIA

Regulations concerning measures for hygiene and safety in undertakings, 25 October 1921.

Workers' Protection Act 28 February 1922. (L.S. 1921, S.C.S. [II] 3.)

(L.S. 1922, S.C.S. 1.)

Act respecting labour inspection. 20 December 1921.
(L.S. 1921, S.C.S. [II] 2.)
